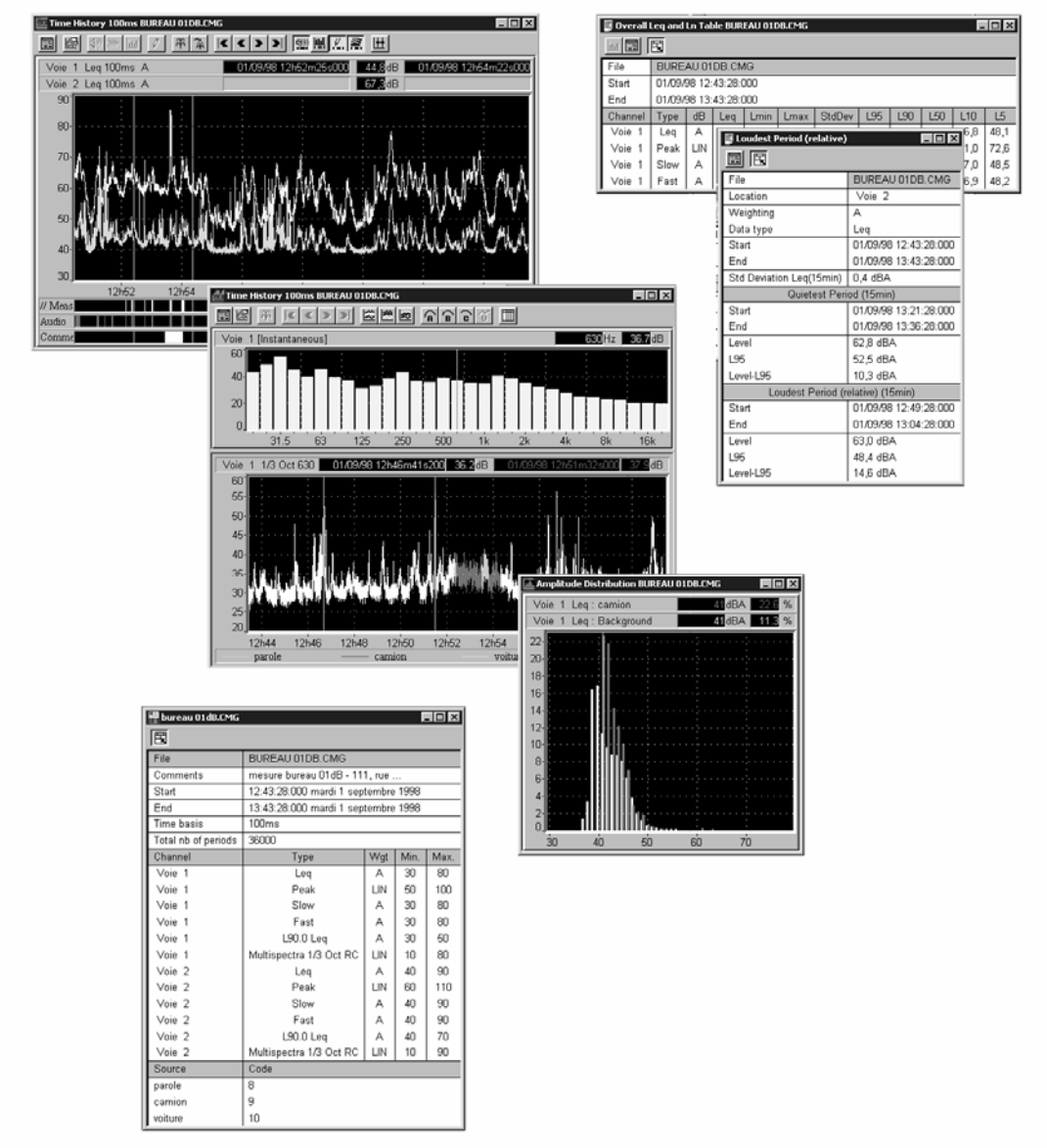
dBTRAIT32 software package processing part of dBENV32


Time History 100ms BUREAU 01DB.CMG
Voie 1 Leq 100ms A
Voie 2 Leq 100ms A
Overall Leq and Ln Table BUREAU 01DB.CMG
File BUREAU 01DB.CMG
Start 01/09/98 12:43:28.000
End 01/09/98 13:43:28.000
Channel Type dB Leq Lmin Lmax StdDev L95 L90 L50 L10 L5
Voie 1 Leq A
Voie 1 Peak LIN
Voie 1 Slow A
Voie 1 Fast A
Loudest Period (relative)
File BUREAU 01DB.CMG
Location Voie 2
Weighting A
Data type Leq
Start 01/09/98 12:43:28.000
End 01/09/98 13:43:28.000
Std Deviation Leq(15min) 0,4 dBA
Quietest Period (15min)
Start 01/09/98 13:21:28.000
End 01/09/98 13:36:28.000
Level 62,8 dBA
L95 52,5 dBA
Level-L95 10,3 dBA
Loudest Period (relative) (15min)
Start 01/09/98 12:49:28.000
End 01/09/98 13:04:28.000
Level 63,0 dBA
L95 48,4 dBA
Level-L95 14,6 dBA
Time History 100ms BUREAU 01DB.CMG
Voie 1 [Instantaneous]
Voie 1 1/3 Oct 630
parole
camion
Amplitude Distribution BUREAU 01DB.CMG
Voie 1 Leq : camion
Voie 1 Leq : Background
bureau 01dB.CMG
File BUREAU 01DB.CMG
Comments mesure bureau 01dB - 111, rue ...
Start 12:43:28.000 mardi 1 septembre 1998
End 13:43:28.000 mardi 1 septembre 1998
Time basis 100ms
Total nb of periods 36000
Channel Type Wgt Min. Max.
Voie 1 Leq A 30 80
Voie 1 Peak LIN 50 100
Voie 1 Slow A 30 80
Voie 1 Fast A 30 80
Voie 1 L90.0 Leq A 30 50
Voie 1 Multispectra 1/3 Oct RC LIN 10 80
Voie 2 Leq A 40 90
Voie 2 Peak LIN 60 110
Voie 2 Slow A 40 90
Voie 2 Fast A 40 90
Voie 2 L90.0 Leq A 40 70
Voie 2 Multispectra 1/3 Oct RC LIN 10 90
Source Code
parole 8
camion 9
voiture 10

01dB METRAVIB

USER MANUAL

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dBTRAIT32

Environmental Noise Data Processing Software Package
User Manual

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1. INTRODUCTION TO DBTRAIT32

1.1. Overview

The software package **dBTRAIT32** has been developed for the treatment of environmental noise measurement data. It represents 10 years of expertise and development. The software is based on the short LEQ theory (developed by P. LUQUET former member of the French Laboratoire National d'Essais and head of 01dB since 1987.

dBTRAIT32 is compatible with all 01dB PC-based acquisition units (**HARMONIE**, **SYMPHONIE**,**JAZZ**) and data-logging sound level meters (**SIP95**, **SOLO**)

Standardised results (such as time history of a given acoustical quantity, Leq and statistical index L_N values over selectable periods, etc.) are available, but the real advantages of **dBTRAIT32** start where those of most dedicated instruments end: time history of a selected spectrum frequency band and associated statistical calculations, playback of audio recordings from within the data plot, frequency analysis, identification and evaluation of noise sources with intelligent coding techniques, etc.

Partnered with the uniquely powerful environmental noise acquisition software **dBTRIG32**, the **dBTRAIT32** application software is an ideal investigation tool, which makes data processing easy and helps the user to analyse any given noise nuisance problem. The user-friendly interface ensures that the inexperienced user quickly becomes familiar with the system and results can easily be exported to word processors or spreadsheets, for documentation or further calculation.

1.2. Main functions

We give below a list of the main functions of the **dBTRAIT32** software package. To use these functions, please refer to the appropriate section of this manual.

- ✓ **Temporal Analysis Of Acoustical Quantities**

  Time history (Short Leq, Peak, Slow, Fast, etc.) displayed on any time basis and over user-defined periods.

- ✓ **Frequency Analysis Of Audio Signals**

  Averaged spectra in octaves and third octaves of audio recordings (1/48th octave band analysis available, depending of the configuration).

Audio signal playback (CD quality sound) from within the time history plot.

- ✓ **Multispectrum Analysis**

  Time history of a spectrum in octaves and third octaves over the whole measurement duration (with **HARMONIE**, **SYMPHONIE** and the **SIP95 real-time module** or **SOLO**) or for audio records (script server **option**) with access to minimum, maximum and averaged spectra (weighted or unweighted), with overall levels.

- ✓ **Result Processing**

  Results shown as tables or colour graphics for direct printing, or export to standard office software to generate measurement reports.

  Overall Leq and statistical indices over selected time periods.

  Leq by noise source and occurrence.

  Cumulative and probability distributions.

  Peak, Lmin, Lmax, Slow, Fast, Impulse, SEL, etc. levels

  Loudest and quietest periods.

✓ **Noise Source Identification**

Coding techniques available to classify noise events.

Automatic (using threshold or time window conditions) or manual coding.

Elimination of unwanted noise events during processing.

Listing of noise events present with Leq and SEL levels, time of occurrence, partial Leq, etc.

✓ **Main Characteristics**

Run under the Windows environment: display of many different windows, quick access to the menu items using toolbar buttons, multitasking with other applications.

Multi-curve display with zoom in/out, autoscale, etc.

On line help provided to guide the non-specialised user.

✓ **Optional Modules**

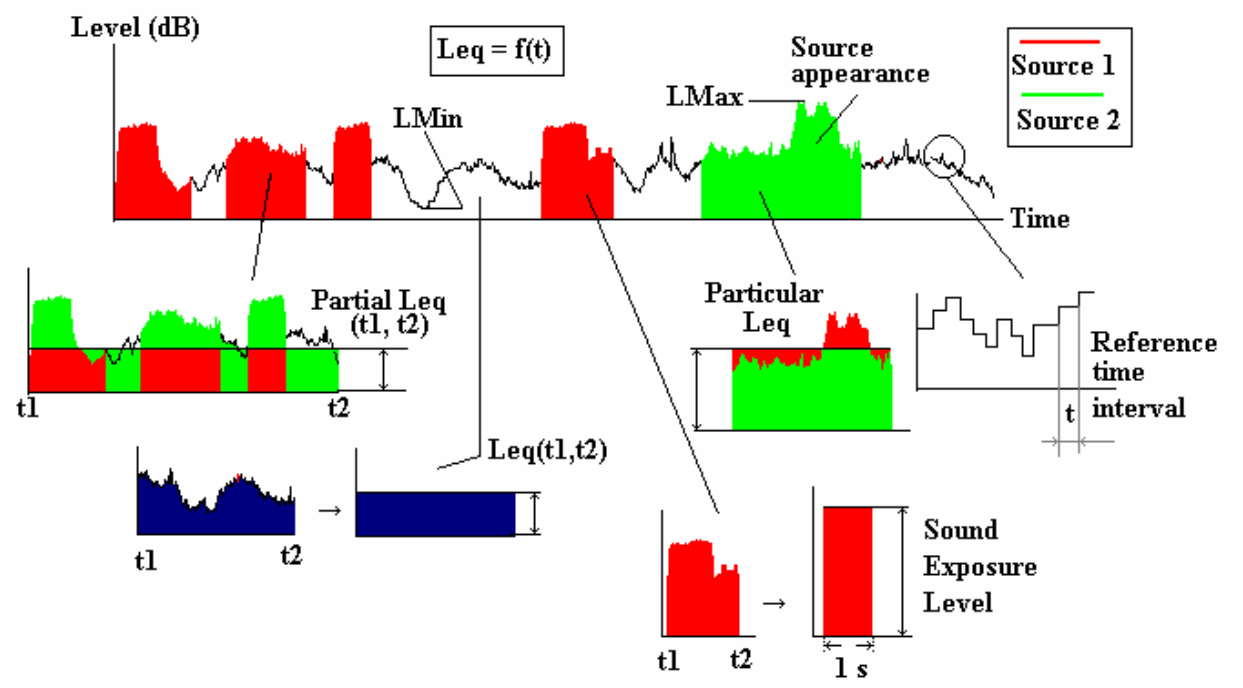
Automatic processing module of a set of measurement files with user-defined scripts and automatic result printing.

Script server: simultaneous frequency analysis and decimation of audio records during processing in **dBTRAIT32** or at the time of acquisition in **dBTRIG32.**

✓ **Standards and Regulations (Options)**

Occupational noise: noise exposure, sound exposure and OSHA indices.

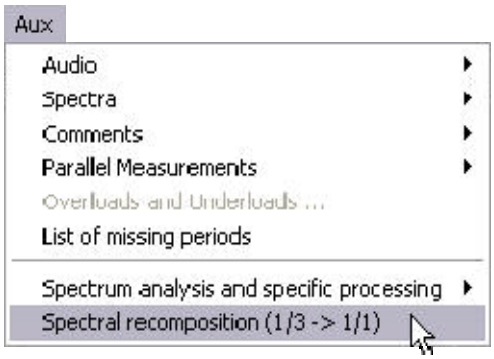
The scheme below describes some of the noise indicators recomposed from the original short Leq data. The quantities described below are defined in **chapter 17** :

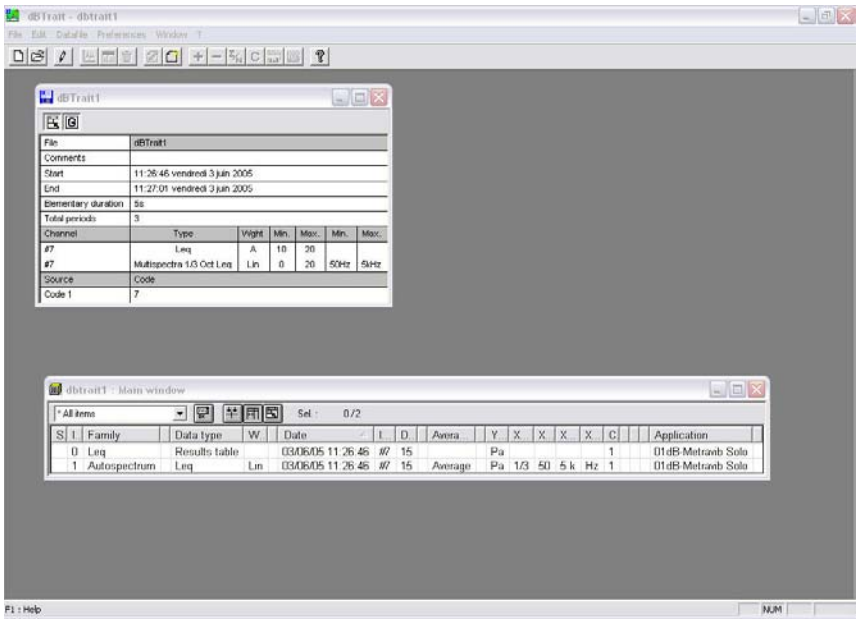


1.3. What is new in dBTRAIT32 v. 4.7?

The new functions of 01dB 32-bit software packages, with respect to **dBTRAIT32**, are listed below :

1.3.1. Version 4.8

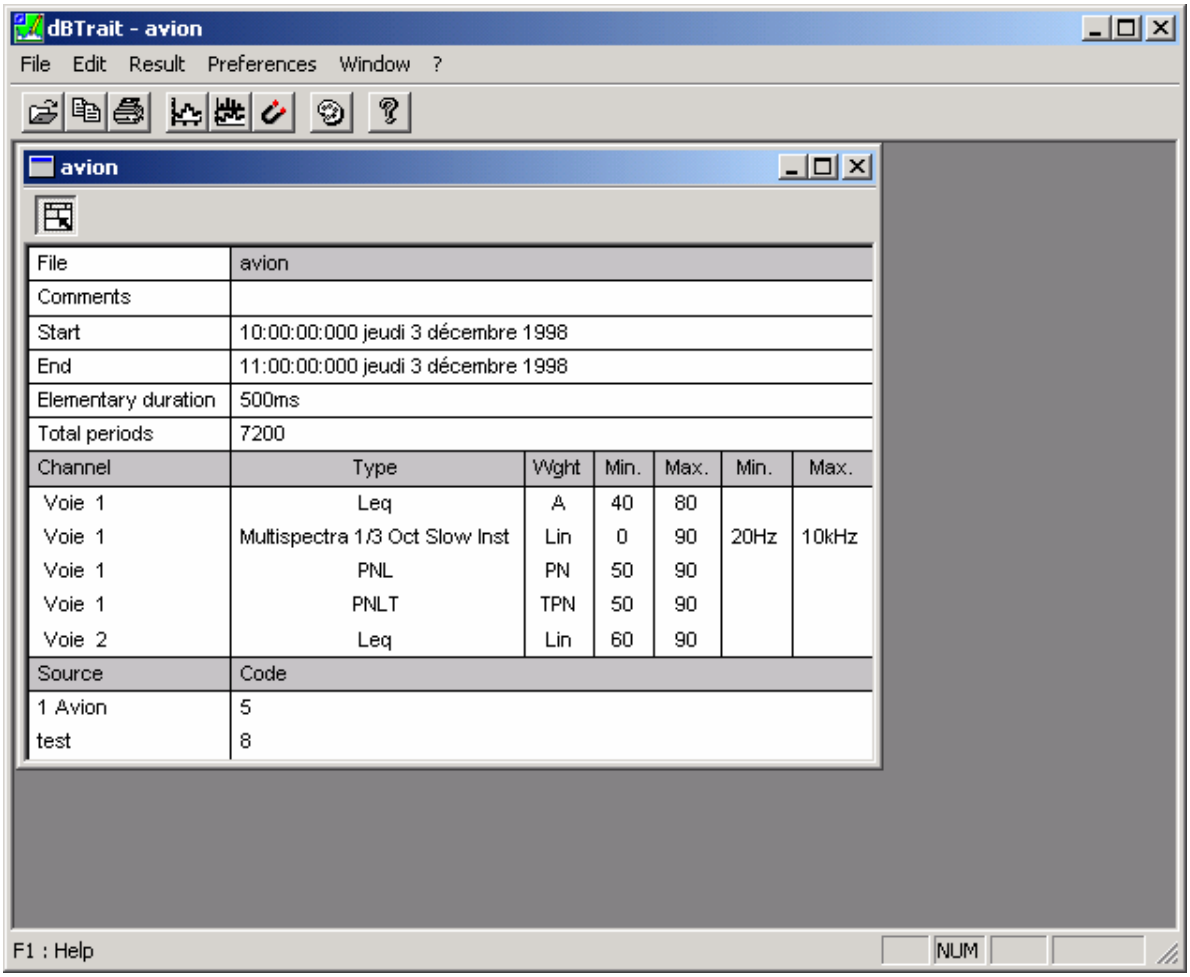




1.3.2. Version 4.7

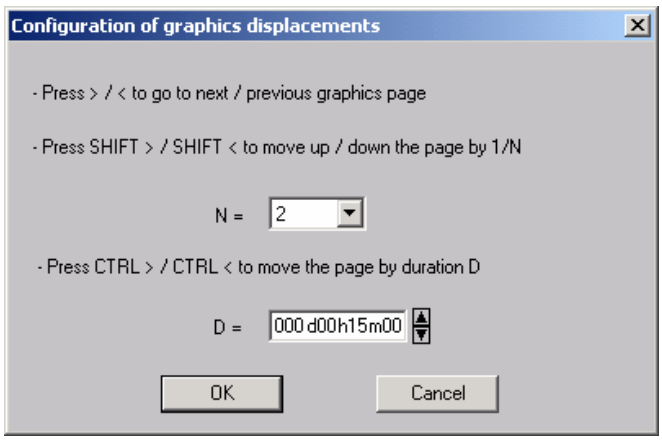
- **Creation of a simplified version of dBTRAIT allowing to:**

- display time history
- display spectrum history
- calculate Leq and statistical indices

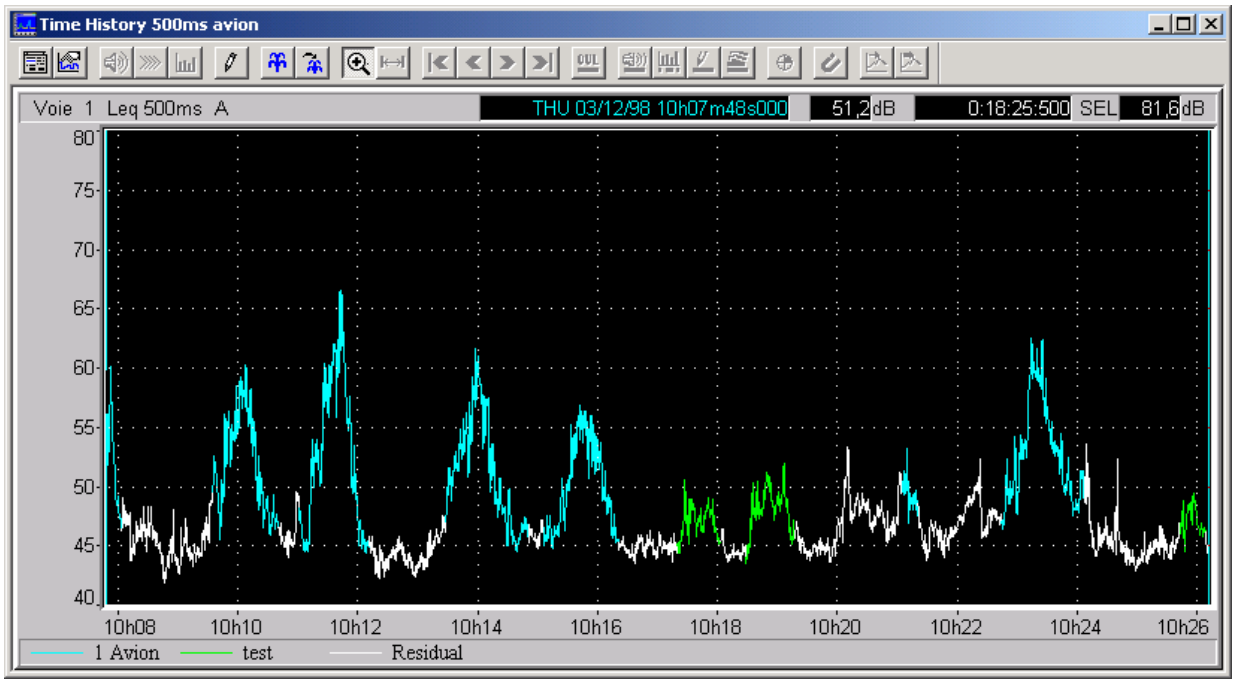

dBTrait - avion
File Edit Result Preferences Window ?
avion
File avion
Comments
Start 10:00:00:000 jeudi 3 décembre 1998
End 11:00:00:000 jeudi 3 décembre 1998
Elementary duration 500ms
Total periods 7200
Channel Type Wght Min. Max. Min. Max.
Voie 1 Leq A 40 80
Voie 1 Multispectra 1/3 Oct Slow Inst Lin 0 90 20Hz 10kHz
Voie 1 PNL PN 50 90
Voie 1 PNLT TPN 50 90
Voie 2 Leq Lin 60 90
Source Code
1 Avion 5
test 8
F1 : Help
NUM

- **New management of displacement on time history plots (see § 12.5)**

- displacement by a nth of a screen by pressing the SHIFT key
- displacement by fixed length of time by pressing the CTRL key



- **Display of time in Leq mode between cursors (see § 5.1)**

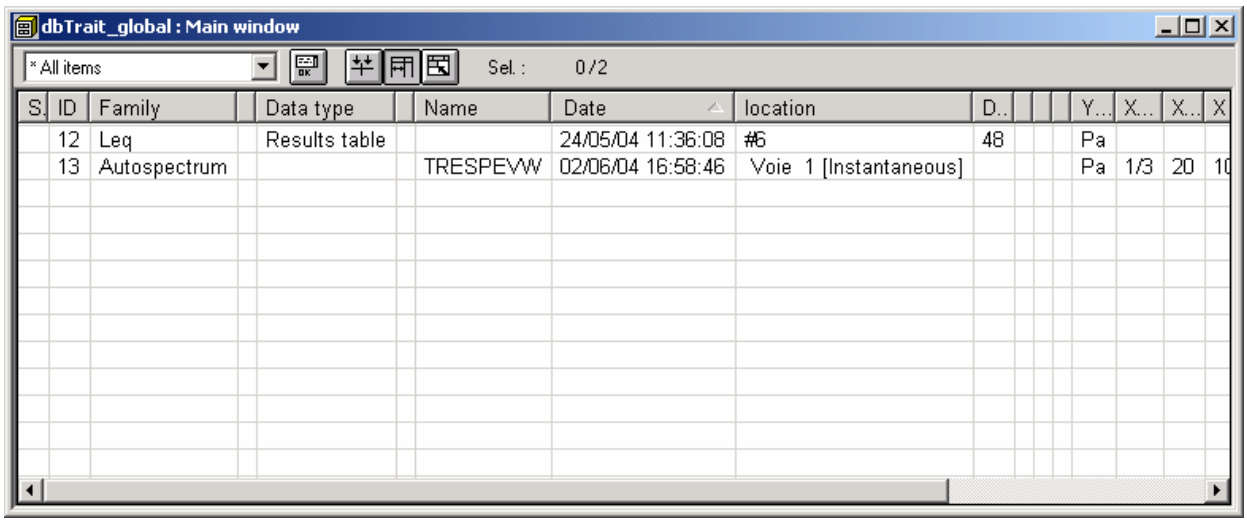


- **New operating of the spectrum listing function : the listed spectrum is identical to the that displayed in the spectrum history view.**

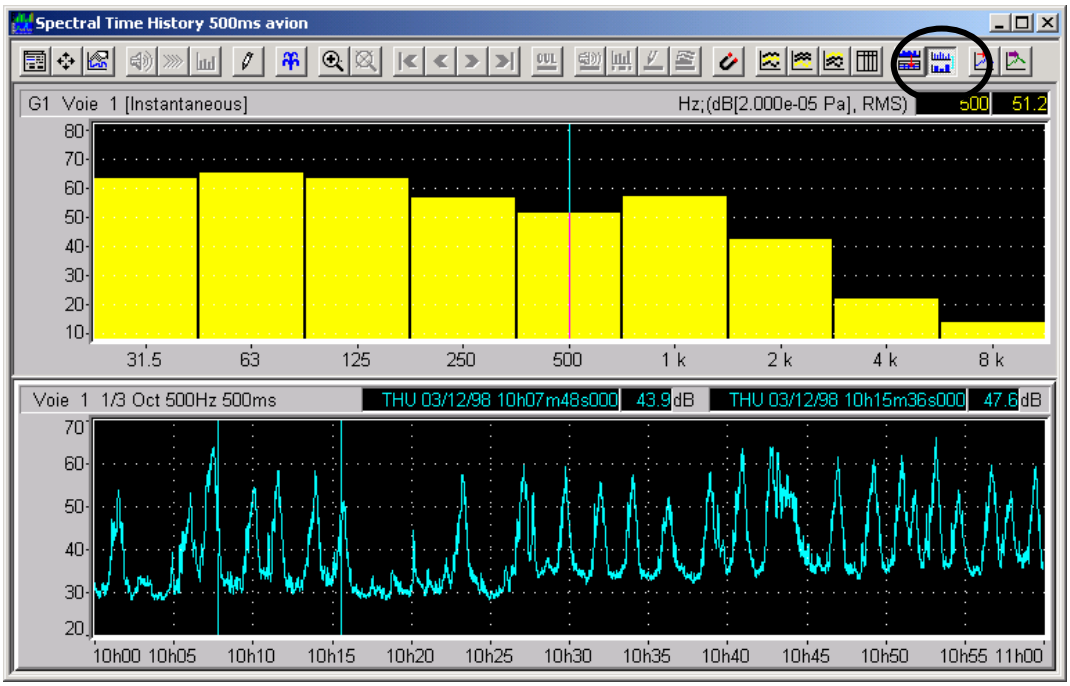
- **New display and management of global items (see § 11)**

- display in a separate view of:
  - spectra and overall values transferred by SOLO
  - instantaneous spectra copied form the spectrum history view

- list, sort and delete items
- change item parameters
- create a spectrum
- add, subtract or average two or more spectra
- recompose a 1/3 octave spectrum into a 1/1 octave spectrum
- correct one or several spectra using a correction spectrum
- display NR/NC curves (option)

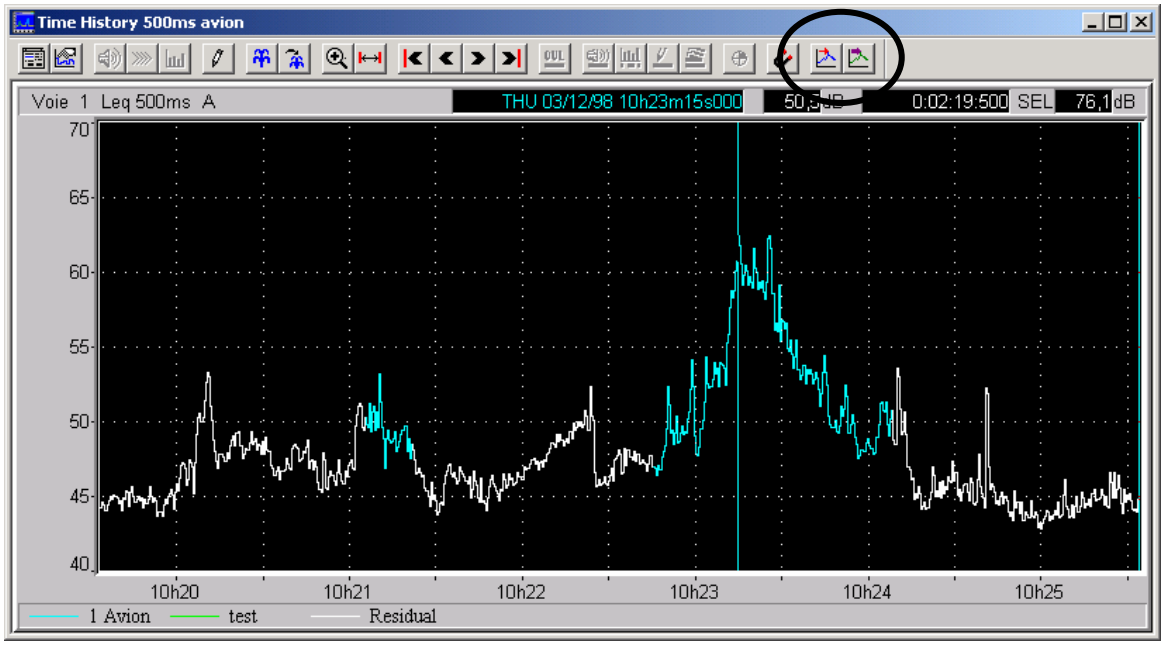

dbTrait_global : Main window
* All items
Sel. : 0/2
S. ID Family Data type Name Date location D.. Y... X... X... X
12 Leq Results table 24/05/04 11:36:08 #6 48 Pa
13 Autospectrum TRESPEVW 02/06/04 16:58:46 Voie 1 [Instantaneous] Pa 1/3 20

- **Recomposition of 1/3 octave spectra into 1/1 octave spectra (see § 5.9)**



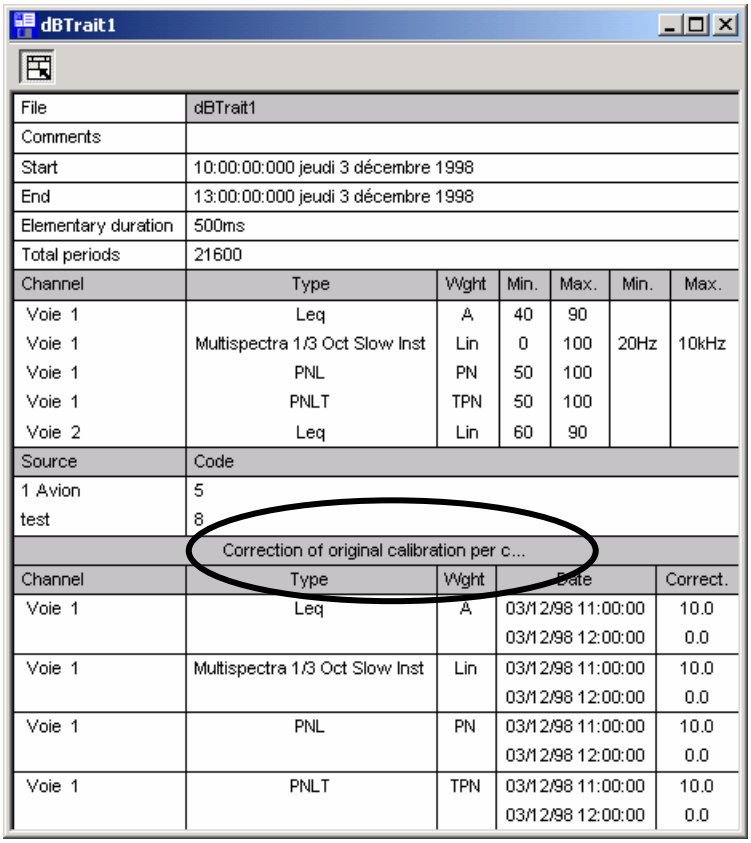
- **Maximum search on time history (see § 4.8)**

- over the entire file
- in the area between cursors



- **Cursor and spectrum synchronisation during audio replay (see § 4.4)**

- **Monitoring of calibration corrections by display in the file header (see § 3.1.2)**



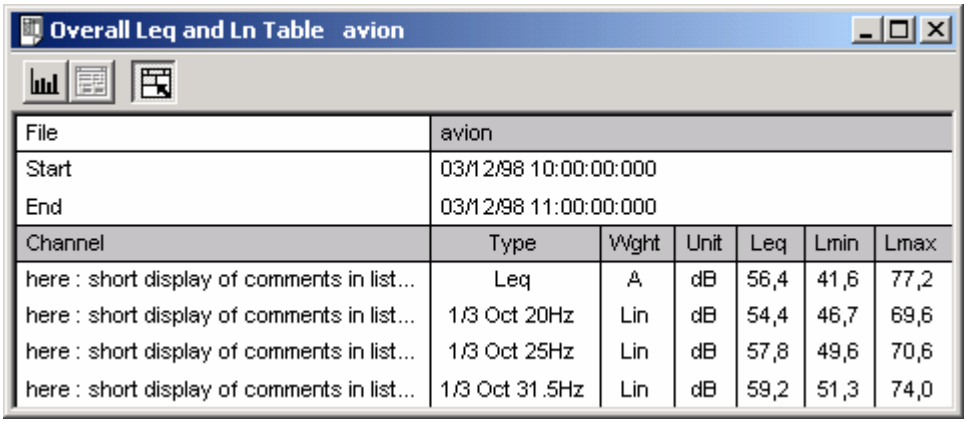
dBTrait1

File	dBTrait1					
Comments						
Start	10:00:00:000 jeudi 3 décembre 1998					
End	13:00:00:000 jeudi 3 décembre 1998					
Elementary duration	500ms					
Total periods	21600					
Channel	Type	Wght	Min.	Max.	Min.	Max.
Voie 1	Leq	A	40	90		
Voie 1	Multispectra 1/3 Oct Slow Inst	Lin	0	100	20Hz	10kHz
Voie 1	PNL	PN	50	100		
Voie 1	PNLT	TPN	50	100		
Voie 2	Leq	Lin	60	90		
Source	Code					
1 Avion	5					
test	8					

Correction of original calibration per c...

Channel	Type	Wght	Date	Correct.
Voie 1	Leq	A	03/12/98 11:00:00	10.0
			03/12/98 12:00:00	0.0
Voie 1	Multispectra 1/3 Oct Slow Inst	Lin	03/12/98 11:00:00	10.0
			03/12/98 12:00:00	0.0
Voie 1	PNL	PN	03/12/98 11:00:00	10.0
			03/12/98 12:00:00	0.0
Voie 1	PNLT	TPN	03/12/98 11:00:00	10.0
			03/12/98 12:00:00	0.0

- **Short display of comments in list tables**



Overall Leq and Ln Table avion

File	avion					
Start	03/12/98 10:00:00:000					
End	03/12/98 11:00:00:000					
Channel	Type	Wght	Unit	Leq	Lmin	Lmax
here : short display of comments in list...	Leq	A	dB	56,4	41,6	77,2
here : short display of comments in list...	1/3 Oct 20Hz	Lin	dB	54,4	46,7	69,6
here : short display of comments in list...	1/3 Oct 25Hz	Lin	dB	57,8	49,6	70,6
here : short display of comments in list...	1/3 Oct 31.5Hz	Lin	dB	59,2	51,3	74,0

2. DATA PROCESSING IN DBTRAIT32

2.1. Analysis capabilities

The **dBTRAIT32** software package processes noise data saved in a measurement session data file with extension **CMG**. A **CMG** data file is a specific data format developed by 01dB to store the time histories of any type of noise quantities and the audio signals. It can be constituted of several channels, each one corresponding to a different type of noise data (LEQ, Peak, SLOW, FAST, Spectra in octaves or third octaves, etc.) for the given measurement channels (**HARMONIE** and **SYMPHONIE**).

The **CMG** data files are written to the hard disk of the computer. They can be created:

- Either by an option of **dBTRAIT32** software package for noise data transfer to the PC from a compatible data logging integrating sound level meter such as **SIP95** or **SOLO**.
- Either by acquisition software such as **dBTRIG32** when using a PC based measurement system (such as **SYMPHONIE** or **JAZZ**).

Processing of a **CMG** data file in **dBTRAIT32** calculates and displays most of the indicators used environmental noise analysis.

Because **dBTRAIT32** can process noise data from various measuring instruments, the table shown below summarises which functions are available in the software as a function of the acquisition platform:

Measurement systems	***Acoustical quantities (Leq, peak, fast, slow, impulse)***	***Audio recordings***	***Spectra in octaves or third octaves***
SYMPHONIE, JAZZ	Yes	Yes	Yes
SIP95, SLS95	Yes	No	No
SIP95 real time	Yes	No	Yes
Functions in dBTRAIT32	Time history Statistical analysis	Playback Frequency analysis	Spectrum time history (Multispectrum) Standard calculations 31-010 (1996)

📖 *Refer to your measuring instrument user manual for further information on noise data acquisition.*

📖 *Any measurement made with 01dB application software is stored in a unique data file : the measurement session with extension CMG.*

2.2. Analysis process

The analysis principle of acoustical quantities in the **dBTRAIT32** software package is very simple. In this paragraph, we present a typical procedure for noise data processing. Most of the following points are optional, either because you will not be able to access to that particular function, either because such analysis is not required.

- **Step 1 : Open one (several) CMG datafile(s)**

  Once the **dBTRAIT32** software is launched, use the command **File / Open** to open a CMG measurement session file that is stored on the computer hard disk.

  Several CMG datafiles may be joined together to create a single measurement file. Use the command **File / Add session**. See **paragraph 3.1.4.**

- **Step 2 : GRAPHICS : Display of a noise quantity time history or a statistical distribution**

  Once a CMG datafile is opened, the analysis process may be started, for example, with a time history display of any acoustical quantity contained in the measurement file (command **Display / Time history**). See **paragraph 4.**

  With the **Symphonie** PC-based measurement system, or the **SIP95 real-time**, simultaneous acquisition of octave or third octave spectra is possible. To display the time history of a given frequency band, use the command **Display / Spectral time history.** See **paragraph 5.**

  A probability distribution of the noise levels may be displayed with the command **Display / Amplitude distribution**. Similarly, use the command **Display / Cumulative distribution** to display a cumulative distribution of the noise levels. See **paragraph 7.**

- **Step 3 : (Optional) Playback and frequency analysis of audio records**

  It is possible to directly playback audio records from a time history plot, by a single mouse click.

  Using the commands of the **Aux**. menu (aux. for auxiliary data) will allow the user to perform frequency analysis of the audio records. See **paragraphs 4.4, 4.5 and 14.**

- **Step 4 : (Optional) Noise source coding**

  Depending on the Leq pattern of the noise data, and with help of user's comments and audio records, noise source identification is an easy operation to perform. When a noise event as been identified, the commands of the menu **Source** allow the operator to code these noise events in the data stream, for later analysis. See **paragraphs 4.7 and 6.**

- **Step 5 : TABLES : Results listings**

  Use the commands of the **Display** menu to calculate, for example, the overall Leq and statistical indices for the whole duration of the datafile or for user-defined time periods. Other calculations give result tables such as Leq by noise source and occurrence, the Peak, Lmin, Lmax, Slow, Fast, Impulse, SEL, etc. levels, the loudest and quietest periods, etc. See **paragraph 8.**

  Optionally, a module can be used to calculate occupational noise indicators. See **paragraph 9.**

- **Step 6 : Printing the results / Edition of a test report**

  Use the commands **File / Print** and the commands of the **Edit** menu to respectively print a time history plot or a table of results and to export the results into word and spreadsheet processors for further calculations and presentation. See **paragraph 12.**

- **Step 7 : Save the measurement session datafiles**

  Use the command **File / Save,** to save any modification made to the current datafile. This command also concatenates any binary file (BID), which contains for example an audio signal, into the current CMG measurement session file. See **paragraphs 3.1.7 and 3.1.11**

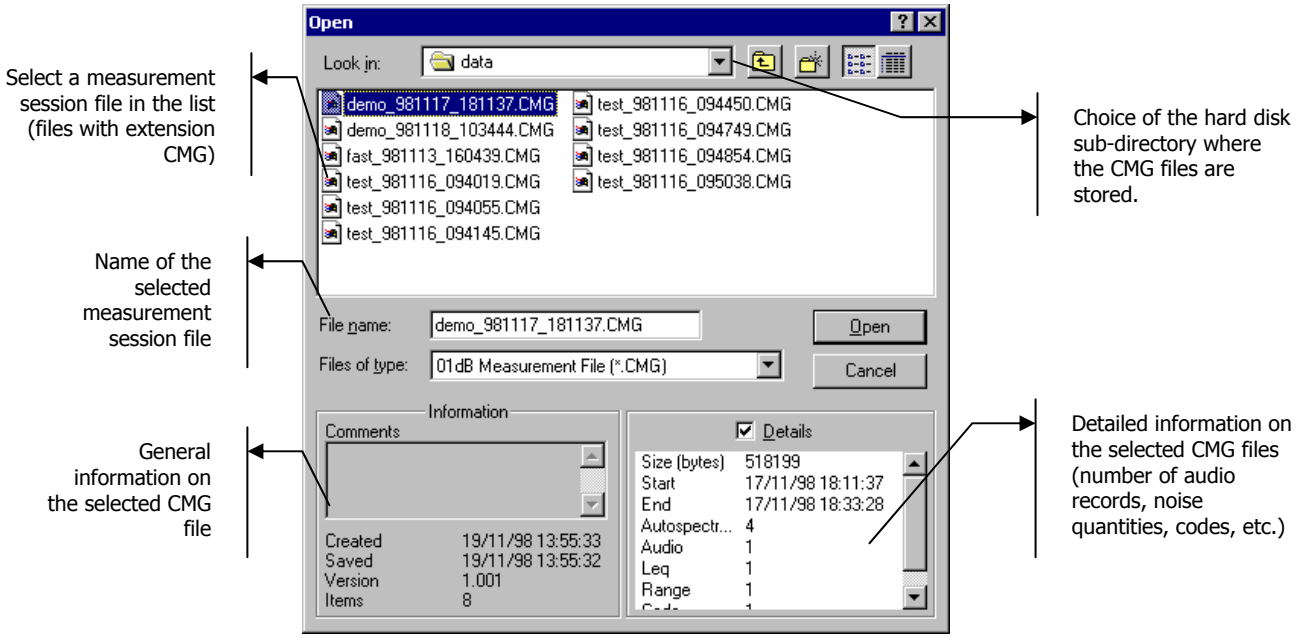
3. DATAFILE MANAGEMENT IN DBTRAIT32

3.1. CMG datafile management (environmental acoustics)

A measurement session data file, with the CMG extension, may represent several megabytes of data and **dBTRAIT32** may work simultaneously on several data files.

3.1.1. Open a CMG datafile

To open a CMG measurement session file stored on the computer hard disk, click on the icon or use the command **File / Open**. The following dialog box appears on screen.



The upper part of this dialog box allows the user to select a measurement session file CMG for processing in **dBTRAIT32** by choosing the appropriate location on the hard disk.

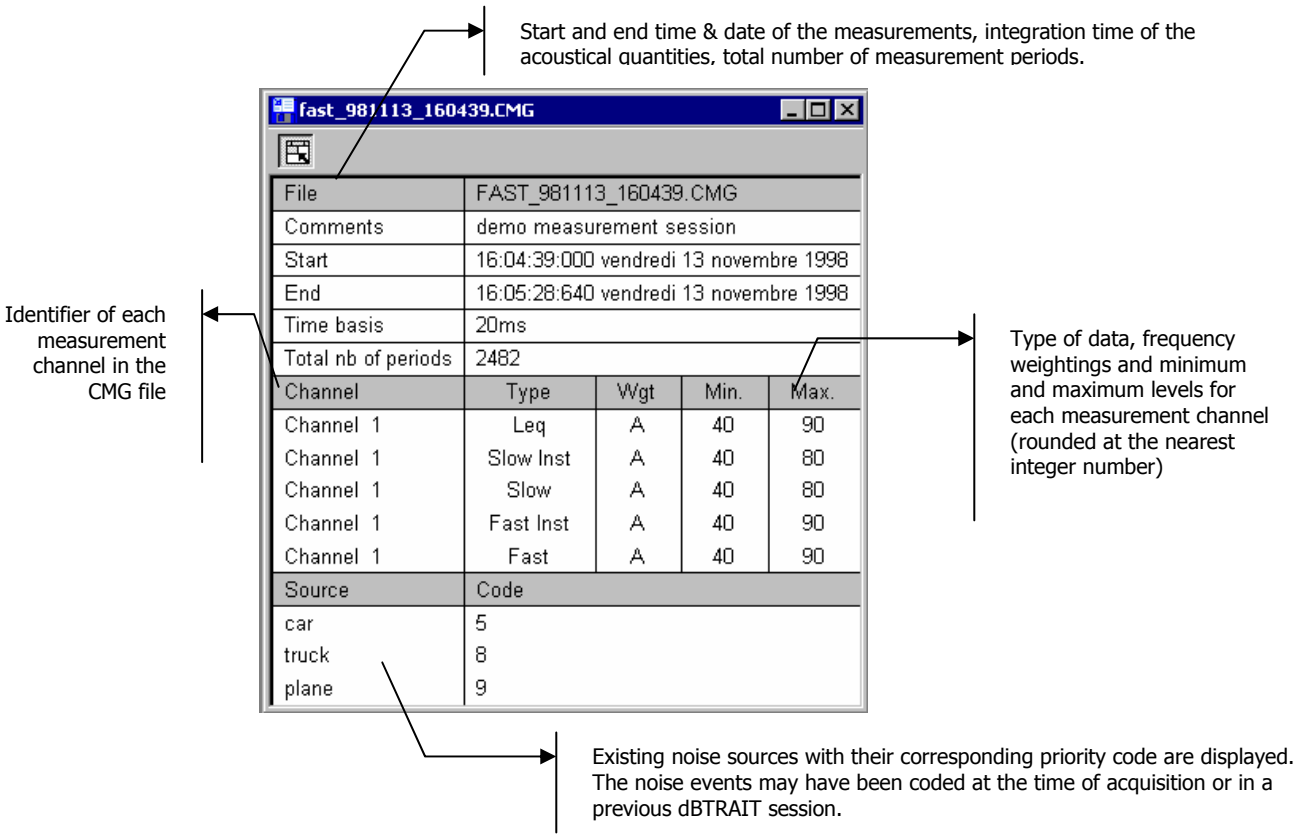
The lower part of this dialog box is activated when a CMG file has been selected in the list. Various information on the datafile are given such as:

- The date and time the file has been first recorded and when it was last saved, the version and the number of items contained in the CMG file.
- By ticking the **details** box, the size in bytes of the datafile, the start and end dates of the measurements, the number of events (audios, spectrums, etc.) as well as general parameters (dynamic range, number of codes, etc.)

Once a file has been selected, click on the **Open** button to open the datafile and proceed with its analysis.

3.1.2. Information window of a CMG file

Once a CMG datafile is opened, the following window is displayed on screen:


Start and end time & date of the measurements, integration time of the acoustical quantities, total number of measurement periods.
fast_981113_160439.CMG
File | FAST_981113_160439.CMG
Comments | demo measurement session
Start | 16:04:39:000 vendredi 13 novembre 1998
End | 16:05:28:640 vendredi 13 novembre 1998
Time basis | 20ms
Total nb of periods | 2482
Channel | Type | Wgt | Min. | Max.
Channel 1 | Leq | A | 40 | 90
Channel 1 | Slow Inst | A | 40 | 80
Channel 1 | Slow | A | 40 | 80
Channel 1 | Fast Inst | A | 40 | 90
Channel 1 | Fast | A | 40 | 90
Source | Code
car | 5
truck | 8
plane | 9
Identifier of each measurement channel in the CMG file
Type of data, frequency weightings and minimum and maximum levels for each measurement channel (rounded at the nearest integer number)
Existing noise sources with their corresponding priority code are displayed. The noise events may have been coded at the time of acquisition or in a previous dBTRAIT session.

The beginning and end times that are given in this window correspond to the acquisition date and time references. **They cannot be modified** during processing.

The field **Channel** lists the noise quantities per physical measurement channel (in the example above, there is one measurement channel for which there are 5 noise quantities: overall A weighted Leq, A weighted time constants Slow Inst, Slow, Fast Inst. and Fast levels).
For each channel, the data **type** (Leq, Peak, Slow, Fast, Impulse, multispectrum, etc.), the frequency **weightings** (A, B, C, Lin, etc.) and the **minimum** and **maximum** values in dB are given.

An information window (or its icon

when minimised) is displayed for each opened CMG datafile. Closing down this window will close the datafile.

3.1.3. Main toolbar for CMG files.

The main horizontal toolbar allows the user to access the following **dBTRAIT32** functions

Most of these functions will be described in this manual.

3.1.4. Add another measurement session to a CMG datafile

Another measurement session may be added to the active CMG datafile by using the command **File / Add session**. The software asks the user to select a measurement session to add to the current datafile. Select the appropriate CMG file in the list and click on the **OK** key.

3.1.5. Delete a CMG datafile

Use the command **File / Delete session(s)** to remove one or several measurement session files as well as all binary files attached to them (*.BID). A dialog box appears on screen. Select the measurement session to delete and click on **OK**.

3.1.6. Close a CMG datafile

To close a measurement session file of type CMG, use the command **File / Close**. Closing down the information window of the datafile will also result in closing the CMG datafile. All others windows (results' listings, time history plots, etc.) will be closed as well.

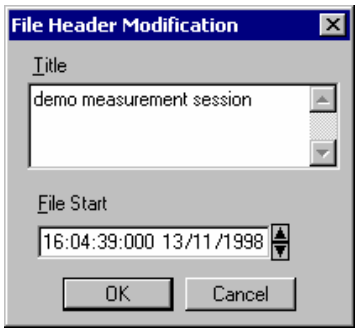
dBTRAIT32 will also prompt the user to save this CMG datafile if any modifications have been made to it before closing.

3.1.7. Save a CMG datafile

Unlike the 16-bit version of the software, modifications made to a datafile in **dBTRAIT32** are not saved dynamically. It is therefore required to use the command **File / Save** or **File / Save As** to save the measurement session on the computer hard disk.

3.1.8. Edit the CMG datafile header

It is possible to modify the header of CMG datafiles by using the commands **Edit / File Header / General parameters** and **Channels**.



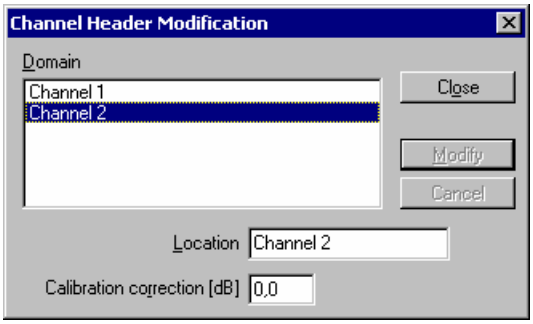
The dialog box **File Header Modification** allows the user to modify the following general parameters:

- The start date and time of the datafile
- The measurement session title

The dialog box **Channel Header Modification** allows the user to modify the following parameters:

- Modification of the **location** of a measurement channel
- The calibration correction factor to apply to the noise data of the selected measurement channel. This correction applies to all data acquired on this channel and included in the measurement session. The correction will be stored in the file header.

After editing these parameters, use the key **Modify** to validate the modifications without exiting the dialog box.

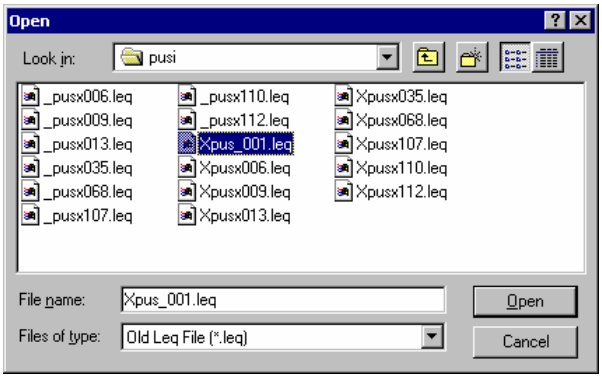


3.1.9. Import LEQ datafiles to the new format

For users of the 16-bit version, it is possible to import old measurement datafiles (LEQ data format) into a measurement session file. Any data linked to the LEQ datafile (WAV files, other LEQ files resulting from an audio record analysis, etc.) will be imported as well, as long as they are located in the same directory of the main LEQ datafile.

To import an old LEQ measurement file, proceed as follows:

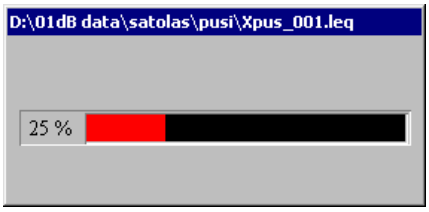
- Create a new measurement session file CMG by using the command **File / New** or open an existing CMG file by using the command **File / Open**. Select a comment for new files and validate.



- Import the LEQ datafile of your choice by the command **File / Import**. The dialog box shown aside appears on screen.

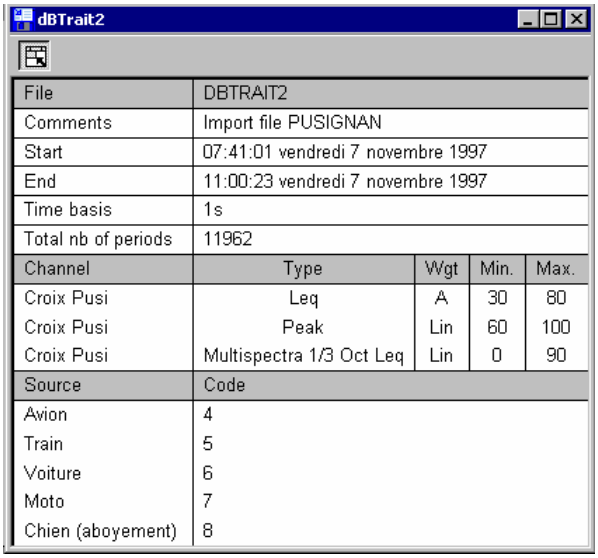
Select the directory and the LEQ file to import in the list. Then click on the **Open** key.

- **dBTRAIT32** then starts the importation process. A dialog box shows the progress. Data imported is stored in the CMG file that was opened previously.



After data from the main LEQ file has been transferred, **dBTRAIT32** imports all the auxiliary data referenced: comments, audio recordings, multispectra, noise source codes, etc.

- When the importation process is ended, the CMG file that was previously opened is updated. The main information window is displayed on screen and looks like this :

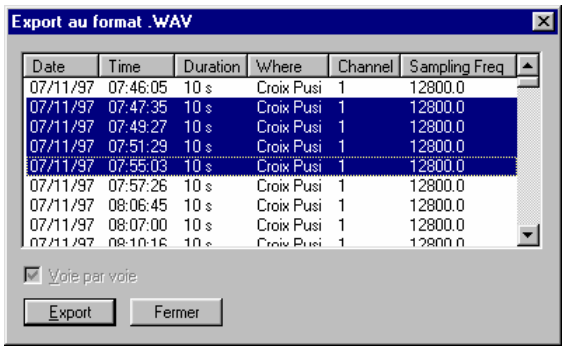


File	DBTRAIT2			
Comments	Import file PUSIGNAN			
Start	07:41:01 vendredi 7 novembre 1997			
End	11:00:23 vendredi 7 novembre 1997			
Time basis	1s			
Total nb of periods	11962			
Channel	Type	Wgt	Min.	Max.
Croix Pusi	Leq	A	30	80
Croix Pusi	Peak	Lin	60	100
Croix Pusi	Multispectra 1/3 Oct Leq	Lin	0	90
Source	Code			
Avion	4			
Train	5			
Voiture	6			
Moto	7			
Chien (aboyement)	8			

- Save the measurement session by using the command **File / Save**.

3.1.10.Export audio records at the WAV file format

It is possible to export audio records at the WAV file format (Microsoft compatible) of 01dB by using the command **Aux / Audio / Export in WAV file format.** The following dialog box is displayed on screen.
In the list of audio records attached to the measurement session, select one or more audio records to export.



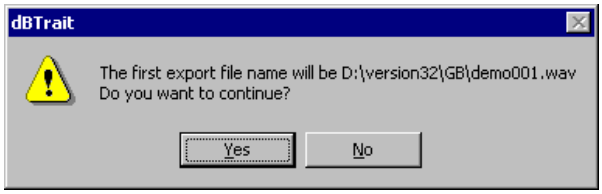
In order to identify the audio records to export, different information is available (date, time, duration, location, sampling frequency).

Once the audio records have been selected, click on the **Export** key.

The **individual channels** option allows the user to export dual channel audio records into two single channel WAV files.

The software then displays a dialog box in which the user gives a generic filename for exporting the audio records. Select a directory on the hard disk and enter a filename, then click on the **Open** button.

A warning message is then displayed to give the complete filename of the first audio record to export. If this name is acceptable, click on the **Yes** button.

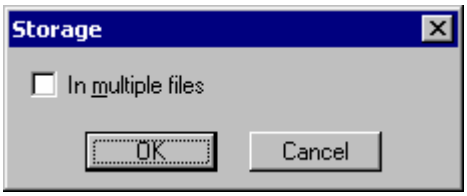


The following records to export are then incremented. For example, the first record could be named DEMO001.WAV while the fourth exported recorded will be named DEMO004.WAV.

The WAV files may then be replayed with the standard multimedia tools of the Windows environment.

3.1.11. Data storage type: concatenate (or not) all files into a single CMG file

The command **Preferences / Storage** allows the user to select the type of data storage of the auxiliary data in a measurement session file CMG.



If the box **Storage in multiple files** (by default) is not ticked, all the auxiliary data would be saved into the measurement session file itself.

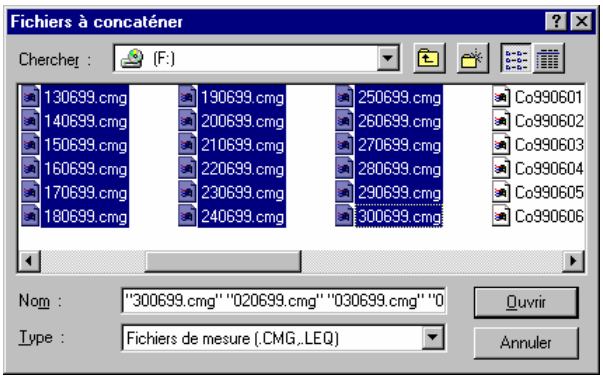
At the contrary, if this box is ticked, the auxiliary data would stored into binary files (*.BID).

Multiple files	Single files
Measurement session file TEST.CMG **Binary files** TEST_1.BID TEST_2.BID TEST_3.BID etc. (according to the number of items created into the session)	**Measurement session file** TEST.CMG **Binary files** none

See paragraph 3.3 for more information about CMG and BID files in dBENV32.

3.1.12. Concatenation of measurement sessions

The user can concatenate several measurement sessions in only one global session with the **File - Concatenation** command.
Select files to concatenate in the following dialogue box:



The user can directly concatenate LEQ files (01dB 16 Bits programs) with CMG measurement sessions. They will be converted to the 32 Bits forma automatically, in order to integrate them in the global CMG measurement session.

Validating this dialogue box creates a **new measurement session in dBTRAIT32 that groups together all measurements**.

This new measurement session file groups together all the records on the same channel, if:

- the records to concatenate **do not overlap temporally**
- the records to concatenate have the **same integration time** (e.g. Leq 1s)
- the records to concatenate have the **same measurement location**

Otherwise the global measurement session displays the different records on **parallel measurement channels**.

The names of all chosen files are displayed on the "Name" line.
The length of this line is limited to 4096 characters. This length can be insufficient for treatments of monitoring files where the number of files to take is high:
Add the following line in the section [Settings] of the file dBTRAIT.INI, in order to increase the size of the input line.

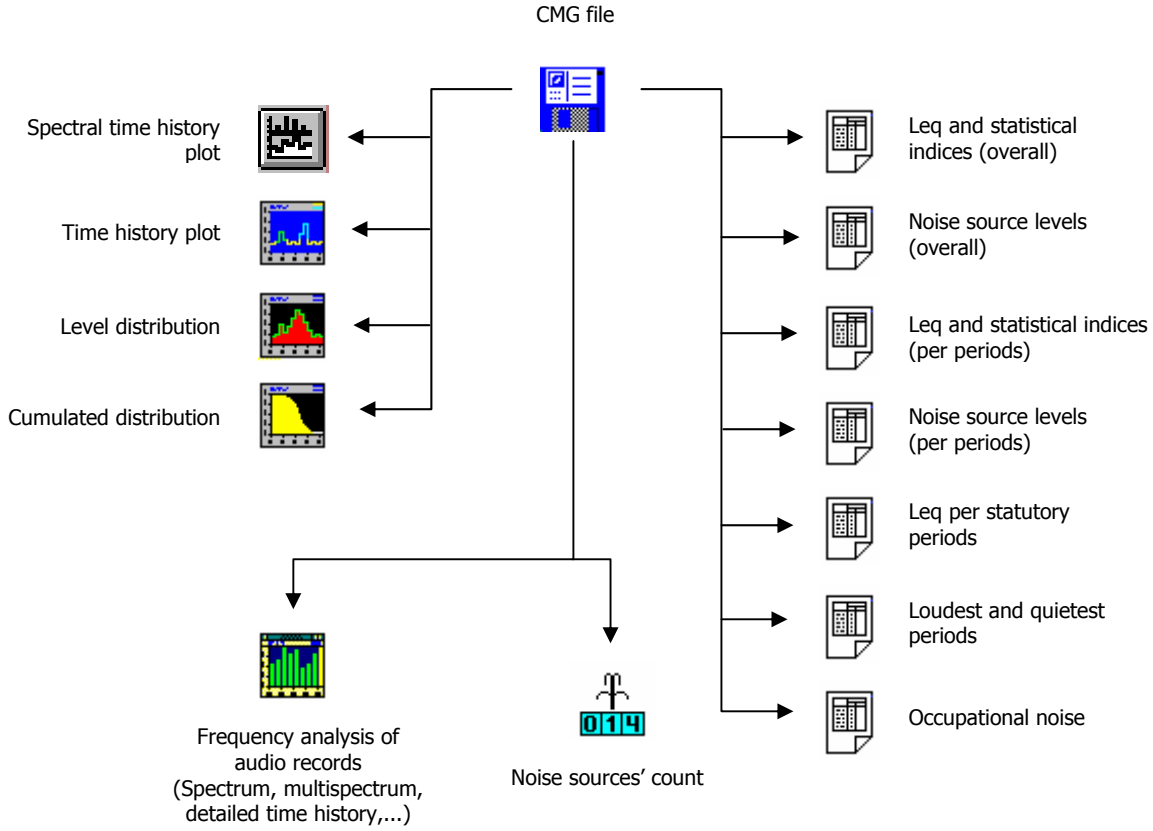
[Settings]

...
MultFileBufSize=16384

The number 16384 is an example.

3.2. Document dependencies in a CMG file

dBTRAIT32 allows the user to work in different measurement session files at the same time. For each file, several windows may be displayed: time history plots, result tables, etc. The drawing shown below describe the hierarchy of all the documents that can be created from a CMG file:


CMG file
Spectral time history plot
Time history plot
Level distribution
Cumulated distribution
Leq and statistical indices (overall)
Noise source levels (overall)
Leq and statistical indices (per periods)
Noise source levels (per periods)
Leq per statutory periods
Loudest and quietest periods
Occupational noise
Frequency analysis of audio records (Spectrum, multispectrum, detailed time history,...)
Noise sources' count

The main window is the file information window to which any other views are related. When closing the main information window, all dependant windows are closed. However, any dependant windows may be closed separately.

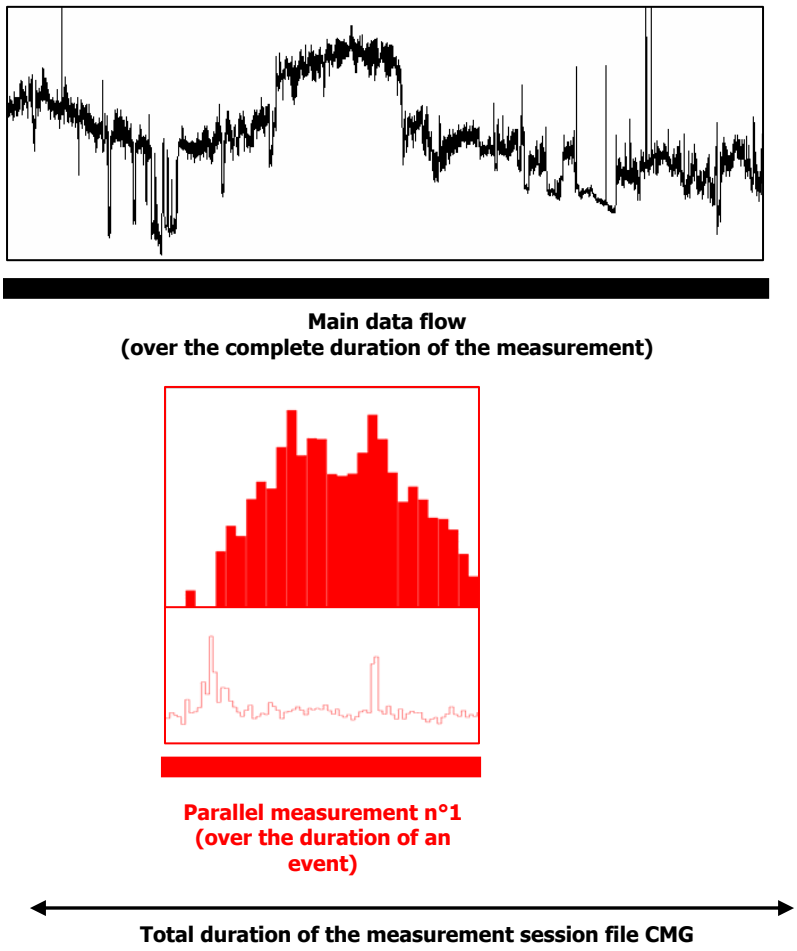
In addition to the acoustical data in CMG files, **dBTRAIT32** references comments, audio records and overloads in the data stream. These audio records can be themselves analysed (averaged spectrum over the event duration, multispectrum, time history of an overall quantity, etc.).

We will therefore speak of **auxiliary data for all these events** and in particular for the multispectra and the detailed time histories of **parallel measurements**.

They can be viewed directly from the time history plot, into information bars. In a more general manner, the auxiliary data can be displayed by the commands of the **Aux**. menu.

It is possible to access directly to any parallel measurement by using the navigation data flow list in the main toolbar. The measurement session information window is refreshed each time a different dataflow is selected.

The drawing shown below is an example of the results obtained for the main dataflow, over the complete duration of the measurement session and a complementary data flow, that is a parallel measurement, over the duration of an event.


Main data flow
(over the complete duration of the measurement)
Parallel measurement n°1
(over the duration of an
event)
Total duration of the measurement session file CMG

Most of the functions listed above can be accessed by the commands of the **Display** menu. A complete description of each function is given in the following chapters.

3.3. Summary: Files used by dBENV32 (dBTRIG32 + dBTRAIT32)

01dB software uses or creates different type of files:
- **Program files**
- **Parameter files**
- **Data files**

- **Program files**

These files are an integral part of the measurement system. They combine libraries of functions (***.DLL files)** that are common to several programmes, executable files **(*.EXE files)** for each specific software modules and driver files (***.DRV files**) specific to each acquisition platform. The drivers establish a communication protocol between the computer, the software module and the acquisition unit.
The programme files also contain the software **help files (*.CHM**)

By default, they are located in **C:\ PROGRAM FILES\01DB\PROGRAMS**. The drivers of the acquisition cards are located under **C:\WINDOWS\SYSTEM.**

- **Parameter files**

These are initialisation and configuration files containing the measurement parameters, the list of characteristics of the different measurement chain elements and the measurement chain configurations of different applications, for example. These files are also located in the same directory as the programmes but are not delivered with the installation CDROM.

When the acquisition software is first used, a file is created to save the essential parameters. If this file is destroyed, it will be necessary to configure the software and hardware again.

See the sketch below.

- **Data files**

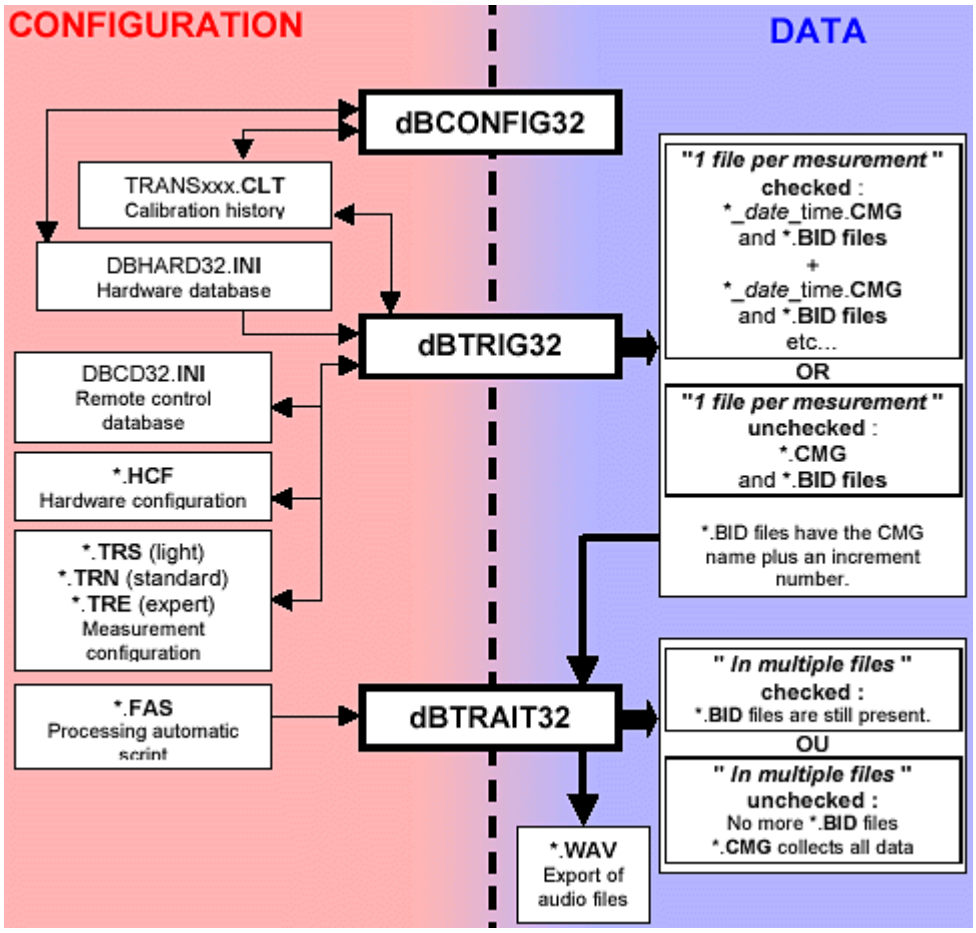
These files contain the measurement results. They can be located anywhere on the computer hard disc. A directory **C:\ MY DOCUMENTS \ 01DB MEASUREMENT SESSIONS** is created by default.

For users that have evolved from a 01dB measurement system running with 16-bit applications to a system running with 32-bit applications, the format of data files has evolved. The files can be imported with the command **File / Import** in the measurement software.

To avoid deleting everything by mistake we advise not to put the measurement files under the same path directory as the programme files.

See the sketch below.

Configuration and Data files used by dBENV32 (see below for further information).



More information are available in :
- **dBCONFIG32** on-line help
- **dBTRIG32** on-line help or manual

In this manual, see paragraph 3.1.11 for information on managing **CMG** / BID files in dBTRAIT32.

3.4. Data transfer from BlueSolo

BlueSolo uses a removable SD-Card memory card to store measured data and recorded audio files. On a Pocket PC, software dBSolo can be used to record oral or written comments. Leq, spectra, audio recordings, written and oral notes can then be transferred to dBTrait.

3.4.1. Transferring data stored in the SD memory of BlueSolo

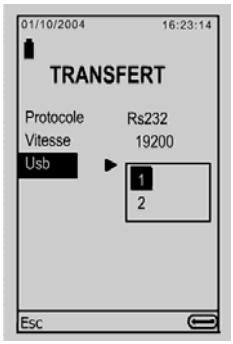
When stored on the SD memory card, binary data are preformatted into files that can be imported directly into dBTrait.

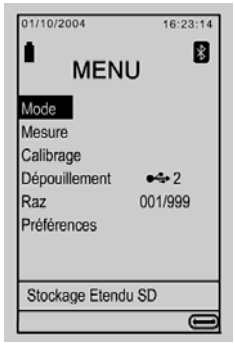
BlueSolo generates two types of measurement files: time history files (*.**BIL**) and recorded signals files (*.**WAV**). Each filename is unique and consists of the BlueSolo serial number (6 characters), followed by the file starting date in format **yymmdd**, and time in format **hhmmss** followed by milliseconds.

Example 1: 656565_060823_170652000.BIL is a time history file originating from sound level meter 656565 started on August 23, 2006 at 17h06m52s000.

Example 2: 656565_060823_170738000.WAV is an audio signal file originating from sound level meter 656565 started on August 23, 2006 at 17h07m38s000.

The following procedure should be adhered to:





- Start BlueSolo.
- Go to the **Preferences** menu, then **Transfer**.
- Select mode **2** next to the **USB** field. Validate.
- In the **Main menu** screen, go to **Results**.
- Turn the computer on, if not already done, and wait for the full start of Windows.
- Connect BlueSolo to the USB port on the computer.
- Windows detects a new peripheral device. Follow the automatic installation procedure (only for the first-time connection).
- Start **dBTrait 4.9** or higher version.
- Click on **File** then **New**. A new – blank – file is created until data are exported.
- Click on **File**, then **Import → Data**
- Browse through removable disk **SOLO 60XXX**, then folder **DATA**.
- Select the time history file (*.BIL). The program will automatically determine which *.WAV files are associated. Validate by clicking on **Open**.
- In menu **File / Save as**, select a location for storage on the computer hard disk.
- *.BIL and *.WAV files contained in the BlueSolo memory can then be deleted using Windows File Explorer.
- BlueSolo can then be disconnected from the PC and turned off.

The "Sound level meter transfer" function of dBTrait must not be used!

3.4.2. Importing notes from the Pocket PC

By default, files containing written or oral comments recorded during the measurement session are stored in folder **\\My Documents\Comments dBSolo** in the Pocket PC memory.

dBSolo generates two types of comments or notes: oral comments (***.WAV**) and written comments (***.TXT**). Each filename is unique and consists of prefix NOTE_BlueSolo serial number (6 characters), followed by the file starting date in format **yymmdd**, and time in format **hhmmss** followed by milliseconds.

Example 1: NOTE_656565_060823_170856000.TXT is written comment file recorded on August 23, 2006 at 17h08m56s000 during a measurement performed with sound level meter 656565.

Example 2: NOTE_656565_060823_170903000.WAV is an oral comment file recorded on August 23, 2006 at 17h09m03s000 during a measurement performed with sound level meter 656565.

Importing files stored in the Pocket PC memory requires two steps:

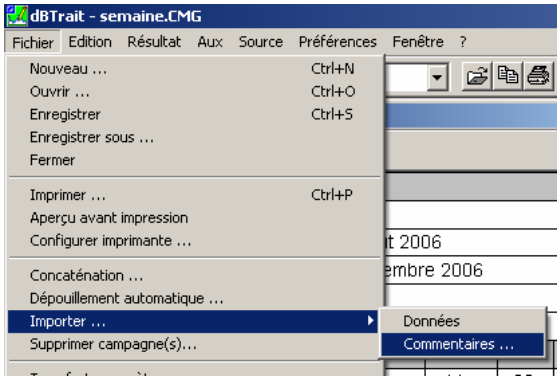
- Transferring the Pocket PC to the computer hard disk using Microsoft ActiveSync.
- Importing files into the measurement session using dBTrait

Configuration of ActiveSync for the automatic transfer of comment files to the computer – to be performed when connecting the Pocket PC to the computer for the first time:

- Install ActiveSync from the CD-ROM provided with the Pocket PC.
- Place the Pocket PC on its base and connect it to the USB port of the computer.
- ActiveSync detects a new Pocket PC. Select **Standard Partnership**, then **Synchronise with this office computer**.
- Select **Files** in the list of synchronisation parameters.
- Click on **Next**, then **Finish**.

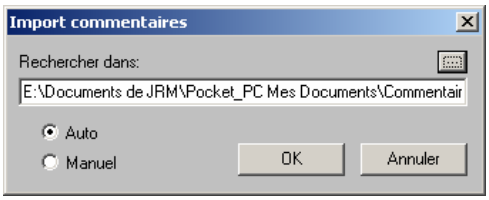
Each time the Pocket PC is connected to the computer, ActiveSync will automatically copy the files contained in folder **My Documents** of the Pocket PC memory to folder **\My Documents\XXXXXX My documents** of the computer (where XXXXXX is the name assigned to your Pocket PC by ActiveSync when setting up the partnership. The default name is "Pocket_PC").

Comment files are imported in the measurement session using dBTrait:



- In menu **File / Open**, open the measurement session previously saved.
- Then, go to **File / Import** and **Comments**
- Click on button **"..."** to browse through file **\My documents\XXXXXX My Documents\Comments dBSolo**.
- Select the importing mode:

"Auto": All comment files associated with the measurement are opened and their end date is transferred and added to the measurement session file.
"Manual": the list of all *.TXT and *.WAV folders can be consulted and files to transfer can be selected.



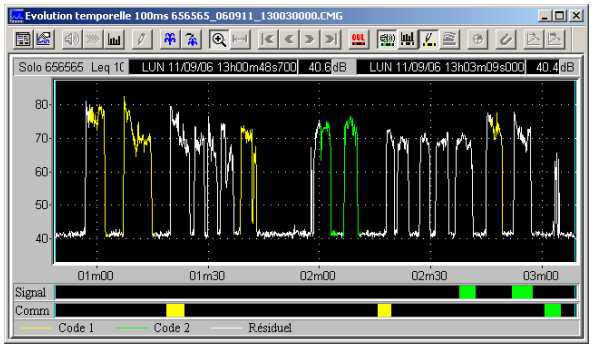
- Click on OK.
- Save the importation using menu **File / Save**.
- Comment files can then be deleted from the Pocket PC memory (during the next synchronisation, they will be automatically deleted from the computer).

If the name of a comment file does not comply with the naming rule used by dBSolo, the program will define the comment date based on the file creation date displayed in Windows Explorer. This allows importing text comments originating from sources other than dBSolo.

For files that do not include any information on time length, it will be set to 0.4 times the total number of characters, in seconds.

3.4.3. Reading data in dBTrait

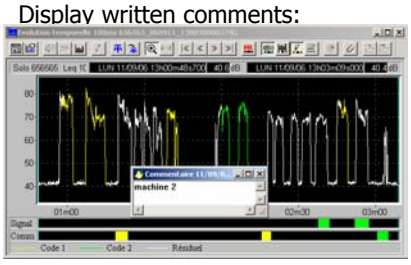
The time history plot is displayed with **Results / Time history**. Four types of data transferred and stored in the measurement session file are displayed:



*** Equivalent levels measured by BlueSolo (Leq, Lp, Spectrum) :** Plot of the time history (in white in the figure) with sources identified by Code 1 (yellow) and Code 2 (green).
*** Recordings of the metrological audio signal by BlueSolo :** Green parts on the **Signal** bar **under the graph**.
*** Written comments saved in dBSolo :** Green parts of the **Comm** bar **under the graph**.
*** Oral comments recorded in dBSolo :** Green parts of the **Comm** bar **under the graph**.

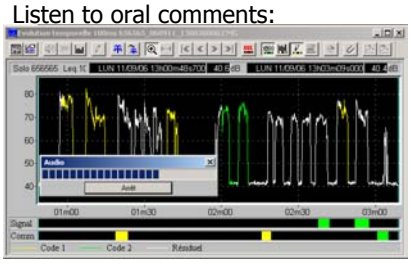
Double click on an event in the Comm bar to:

Display written comments:



Written comments can be edited and saved.

Listen to oral comments:



No processing can be applied to comments.

4. TIME HISTORY PLOT

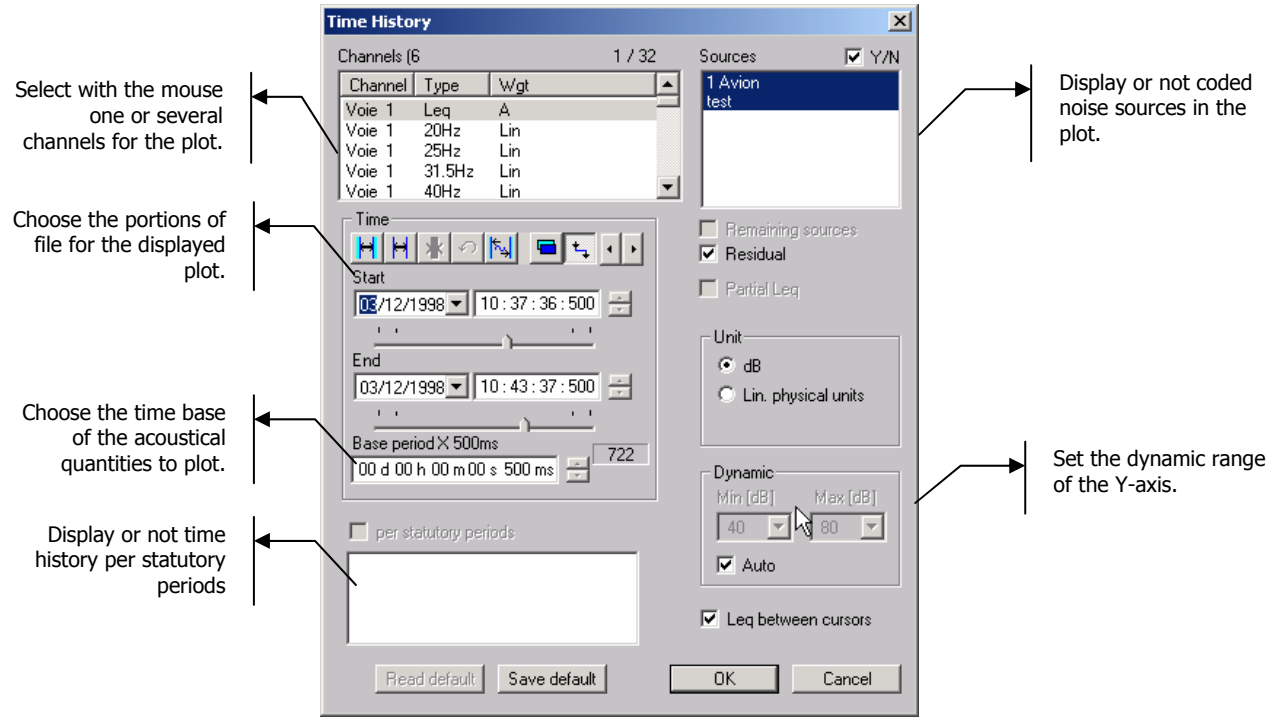
The time history plot is one of the main plots available in **dBTRAIT32**. It represents a plot of sound levels in dB (calculated according to a user-defined time base) as a function of time. The noise data is taken from a CMG datafile. Such plot gives not only an overview of a noise climate for a given environment, but also an in-depth description of particular noise events.

The time history plot may or may not display existing noise events. In this case, the noise sources will be displayed with different colours on the plot.

Audio records can be played back through the sound system of the computer directly form the time history plot. Further analysis of audio signals can also be launched from this plot.

4.1. Configuration parameters of the plot

Once a measurement datafile is opened, click on the icon or use the command **Display / Time History** to plot a sound level time history of any acoustical quantity present in the CMG datafile. The following dialog box is displayed on screen. Define the parameters of the plot. On validation of this dialog box, the time history plot will be displayed in a new window.



The following parameters may be defined:

- **Channels**

The acquired acoustical quantities stored in a CMG datafile that can be plotted. For each measurement channel, different types of noise data can be available. A maximum of six channels can be displayed simultaneously on a time history plot.

- **Timetable**

Specify the beginning and ending time of the file section to plot (the format of this selection is **hh:mm:ss:ms dd/mm/yy**) or the beginning time and the length of the section to take into account.

Icons are used to, respectively:

- Select the entire file (i.e., data over the total length of the file)
- Select the entire channel (i.e., data over the total time length of the channel)
- Select data between cursors placed on the plot
- Go back to original times
- Round up times (rounding calculation depends on the total duration of display)
- Select whether to display ending time or duration
- Link starting and ending cursors.

- **Base plot step**

The plot may be displayed using the default time base of the acoustical quantities in the datafile or a greater time base.

During acquisition, an elementary time base has been used to store the short Leq data (usually 125ms or 1s). It is possible to recalculate noise levels according to a greater time base (for example 15-min) that is a multiple of the default integration time. **dBTRAIT32** adjusts automatically the base plot step to the nearest value that matches an elementary time base multiple.

Similarly, it is not possible to recalculate noise indicators according to a step that is smaller than the acquisition time base.

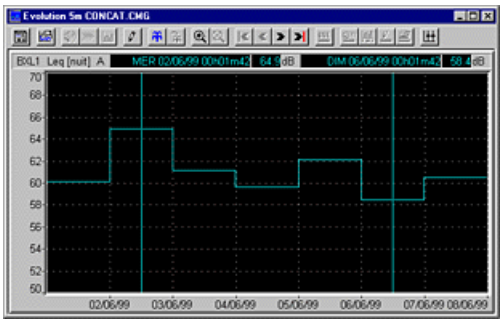
- **Partial Leq**

The Partial Leq is an equivalent sound pressure level of a specific noise source over a selected time portion. The partial Leq is related to the duration of each period and is calculated regardless of sources' duration.

📖 *The option **Partial Leq** is activated only when a time history plot is displayed according to a base plot step greater than the acquisition time base.*

- **By statutory periods**

Displays the chosen values according to the statutory periods defined in the command Preferences - Statutory periods (chapter 10).



The plot displays then **one value per statutory period** in the studied period.

Example: If studying a signal over one week and selecting "Night - 22h - 8h" as statutory period, the plot displays only 7 values per channel (see dialog aside).

This function is useful for long term monitoring measurements as the Concatenation function in the measurement session (paragraph 3.1.12).

- **Sources / Remaining sources / Not coded**

Select in a list the noise sources to consider (or not) for the plot. If one wish to display noise sources (box **Y/N** ticked) on the plot, they will be shown in different colours in order to differentiate them from the rest of the data.

The option **Remaining sources** allows the user to plot all sources that have not been selected, except the background noise, as a single source named "remaining sources". This option may be useful to estimate the contribution of a source compared to all the other sources, for instance. The selection will be recalled as default value next time such a command is used.

📖 *This option is not active when no source is identified or when all the sources have been selected in the list.*

The option **Background noise** allows the user to represent all the noise data in the file that have not been coded as a specific noise source called "background noise". The selection will be recalled as default value next time such a command is used.

📖 *When more than one channel are selected for the plot, the identified noise sources cannot be displayed on it.*

- **Dynamic range**

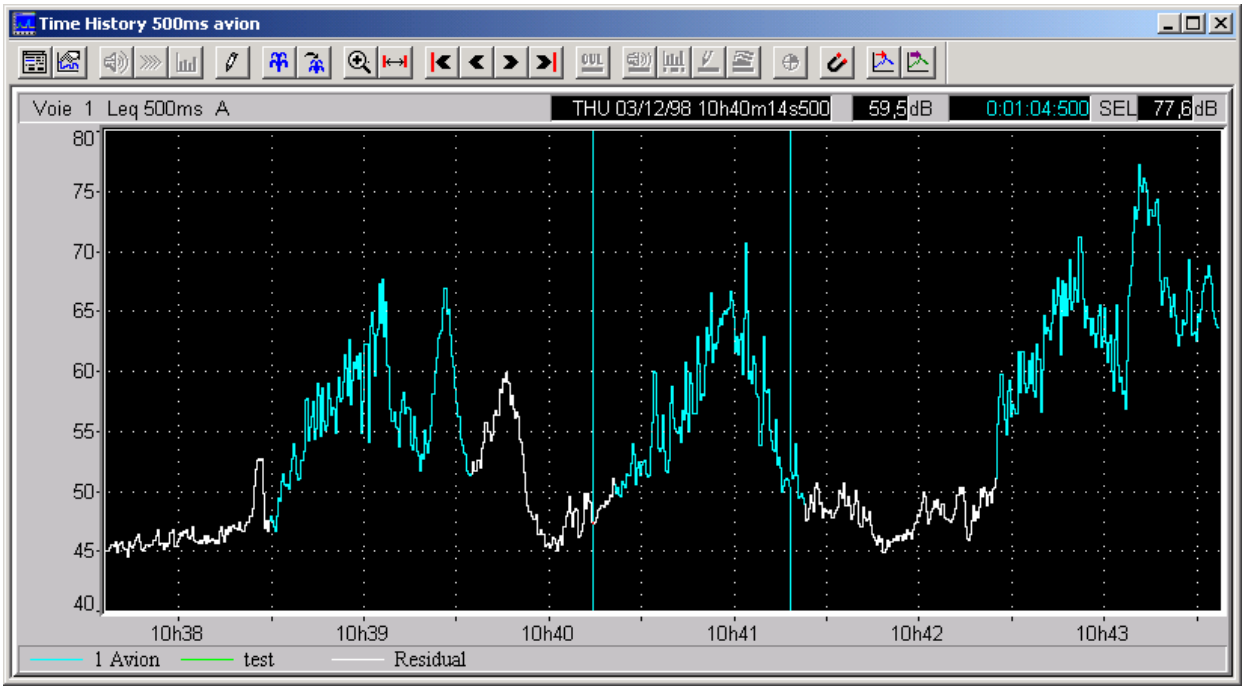
Select the minimum and maximum values of the Y-axis in dB for the plot. On validation, these parameters will be applied to the plot. To automatically adjust these values, tick the box **Auto.**

- **Leq between cursors**

This option allows the user to calculate the equivalent sound pressure level corresponding to the time portion in between the cursors of the time history plot. This value is displayed on the time history plot.

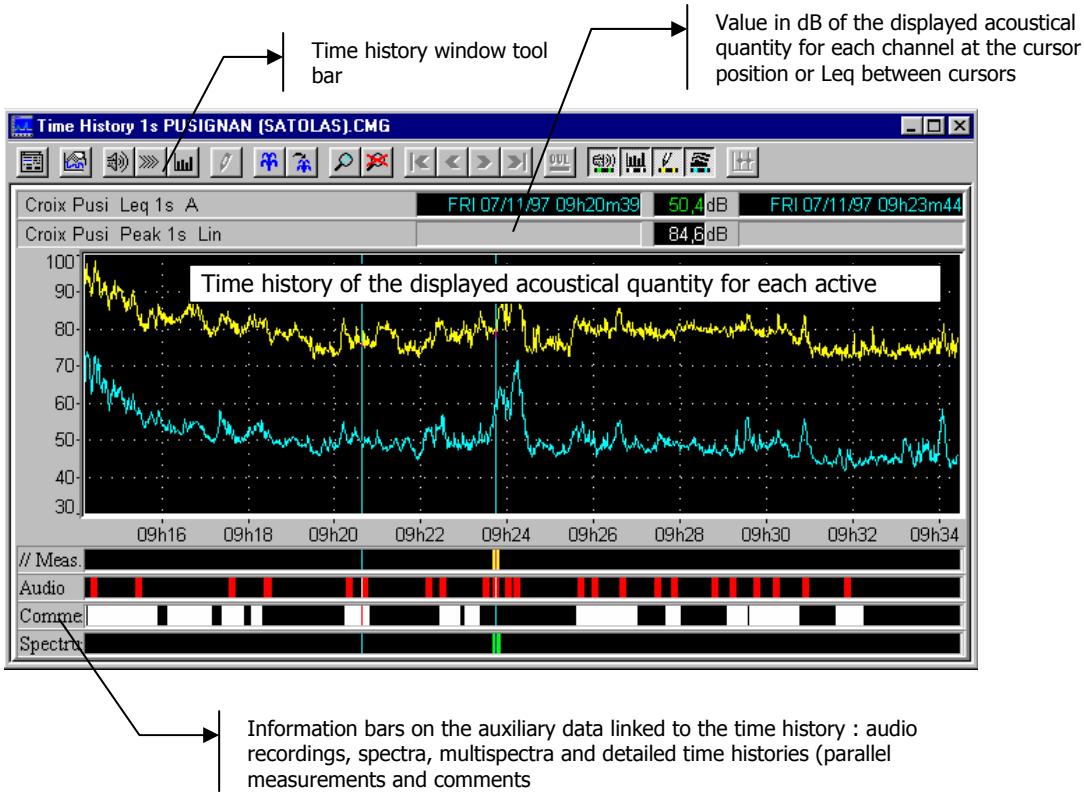
- If this value is not checked, the dB value of the acoustic magnitude is given for each cursor position on the time history plot.

- If this value is checked, the following default parameters will be displayed:
  - Date for left cursor
  - Average Leq between cursors
  - Time length between cursors
  - SEL value between cursors (SEL calculated over the entire section between cursors does not take Max – 10 into account).



📖 To display the date for the 2nd cursor, one needs to modify the dBtrait.ini file and set *ShowDuration* to 0 in the [Settings] section.

4.2. Time history plot display



The time history plot window features a tool bar that gives access to functions such as coding a noise source between cursors, analysing in frequency and /or time domains, audio records playback, editing comments, etc.

dBTRAIT32 can display up to five information bars, which represent auxiliary data associated with the time history plot:

- **Overload bar (OVL)** that references any overload or underload
- **Audio bar (Audio)** that references audio recordings made during acquisition
- **Comments' bar (Comm)** for information on the measurement session.

When audio recordings are processed:

- **Spectrum bar (Spect)** that shows an averaged spectrum in octaves, third octaves or 1/Nth octaves.
- **Multispectrum and zoom bar (// Mes)** that shows respectively a spectral time history plot in octaves, third octaves or 1/Nth octaves and a detailed time history of an overall noise quantity.

A **double click** with the mouse on these events allows the user to display in another window the auxiliary data (playback of an audio record, display a spectrum, a multispectrum, a detailed time history or a comment).

All actions dealing with auxiliary data are accessible through the commands of the **Aux**. menu. It allows the user to manage these events (edition, delete events, analyse audio records, display events, etc.).

The **Parallel measurements** bar corresponds to the analysis of audio records that vary with time, such as a multispectrum or a detailed time history. Access directly to such measurements by using the data flow navigation bar in the main toolbar of **dBTRAIT32**.

4.3. Time history plot toolbar / time history menu

Set plot parameters

Set display parameters

Listen to the audio record corresponding to the cursor position

Analysis of the audio record corresponding to the cursor position

Display the spectrum corresponding to the cursor position

Edit a comment between the cursors positions

Identify a noise source (code) for the time portion between the cursors' positions

Search the next occurrence of a noise source

Zoom on the time history section between cursors

Plot section between cursors in another window

Display first section of the file

Display previous section of the file

Display next section of the file

Display last section of the file

Show / Hide overload bar

Show / Hide audio bar

Show / Hide spectrum bar

Show / Hide comment bar

Show / Hide parallel measurement bar (auxiliary data that varies with time)

Link the cursors together

Search Max level on current view

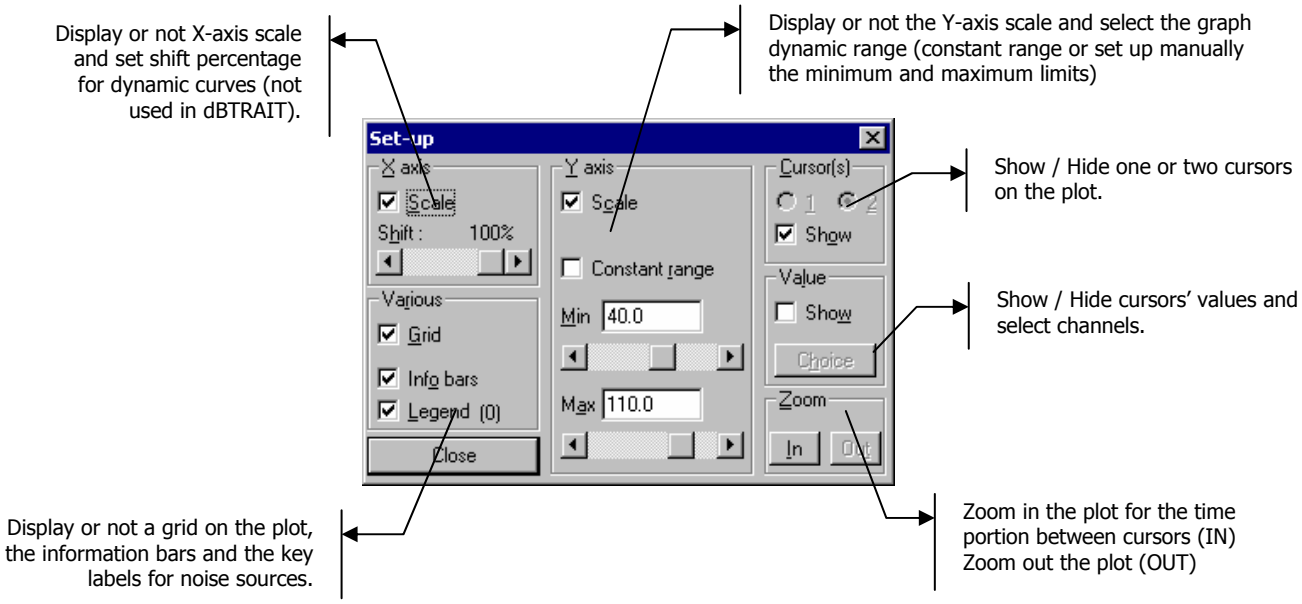
Search Max level on entire file

These commands are also accessible from the **Time history** menu (activated when the active window is a time history) or by clicking on the time history with the right mouse button.

4.3.1. Set-up graphical display parameters

Set-up the graphical display parameters by clicking on the icon or by using the command **Time History / Configure plot.**

The plot is updated immediately when a modification is made. Each plot has its own settings' dialog box: a modification on one plot does not affect the settings of another plot.


Display or not X-axis scale and set shift percentage for dynamic curves (not used in dBTRAIT).
Display or not the Y-axis scale and select the graph dynamic range (constant range or set up manually the minimum and maximum limits)
Set-up
X axis
Scale
Shift : 100%
Y axis
Scale
Constant range
Min 40.0
Max 110.0
Cursor(s)
1
2
Show
Value
Show
Choice
Various
Grid
Info bars
Legend (0)
Close
Zoom
In
Out
Show / Hide one or two cursors on the plot.
Show / Hide cursors' values and select channels.
Display or not a grid on the plot, the information bars and the key labels for noise sources.
Zoom in the plot for the time portion between cursors (IN)
Zoom out the plot (OUT)

4.3.2. Display noise data by time portions

It is possible to navigate from a time section of the data file to another by using the icons or the commands **Time history / File start ; Previous section ; Next section ; File end** if the time history plot display does not cover the complete duration of the datafile.

Example: For a 24-hour measurement file (starting at 08:00am and ending at 08:00am the next day), the operator display a time history plot for the time portion starting at 16:00 and ending at 17:00:

Click on the icon to display the next time portion of the plot 17:00 – 18:00, then

Click on the icon to display the last time portion of the plot 07:00 – 08:00, then

Click on the icon to display the previous time portion of the plot 06:00 – 07:00, then

Click on the icon to display the first time portion of the plot 08:00 – 09:00.

🕮 *If the complete file is displayed on the plot, the time portion icons cannot be accessed (greyed).*

4.3.3. Display information bars

With the icons or the commands **Time history / Information bars / ...,** it is possible to display or hide information bars of auxiliary data.

The overload and underload may also be displayed (icon) if overload or underload occurred at the time of measurement.

📖 *The information bars are only accessible if events occurred. If, for example, no audio signal was recorded at the time of acquisition, the audio bar icon is greyed. If no audio record has been analysed, the other bars will be greyed.*

4.3.4. Edit and display comments

It is possible to insert a comment with the icon in the time history plot. The comments may be used, for example, to describe the measurement conditions (weather conditions, emplacement of microphone, etc.).

To insert a command:

- Place both cursors of the plot on the considered time portion
- Click on the icon
- Input text in the comment dialog box

Display the comments on screen by double clicking on the event in the comment information bar or use the command **Time history / Display / Comment.**

📖 *The comments are used as a notepad and are stored within the datafile. This is useful when the user wishes to exploit again old measurement results, and if the hand notes made at the time are lost.*

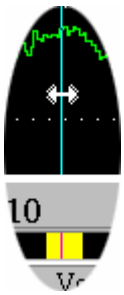
4.4. Playback an audio record / Aux. menu

When audio signals have been recorded at the time of acquisition, it is possible to play them back through the computer sound system. Audio replay can be achieved in various ways:

- **Directly from the time history plot display**.

To do so, display the audio bar by clicking on the icon . It is then displayed below the plot. Double click with the mouse on an audio event. The audio record is then replayed through the sound system of the computer (multimedia sound card or output of the **Symphonie** acquisition box).

- **Directly from the time history plot display, with a cursor**



To do so, display the audio bar by clicking on the icon . It is then displayed below the plot. Move the cursor on the audio event to playback as shown.

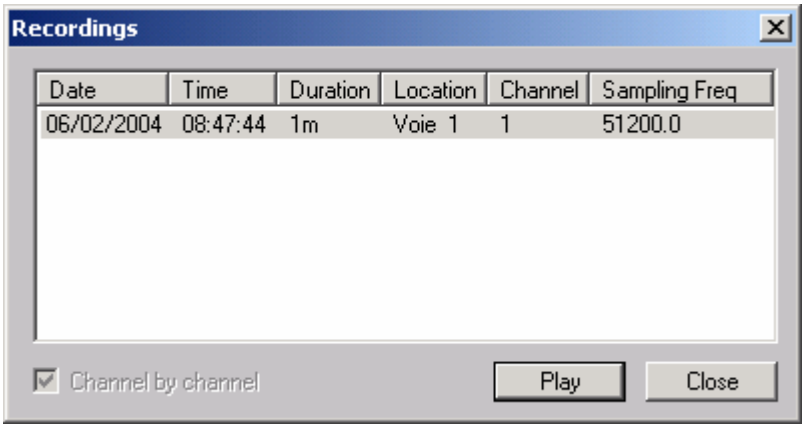
Click on the icon or use the command **Time history / Replay**. The audio record is then replayed through the sound system of the computer (multimedia sound card or output of the **Symphonie** acquisition box).

🕮 *If the active cursor is not placed on an audio event, the replay button cannot be accessed.*

- **From the Aux. menu of dBTRAIT32**.

Audio records can also be played back as soon as a CMG datafile has been opened.

To do so, click on the icon or use the command **Aux. / Audio / Replay.** If more than one audio files have been recorded, a dialog box is displayed (see below) that allows the user to choose which audio records should be played back. After selecting the audio signal in the list, click on **Play** to listen to it on the computer sound system (multimedia sound card or output of the **Symphonie** acquisition box).



The option **Individual channels** allows the user to playback dual-channel audio signals separately (channel 1 and channel 2 are identified in the list). If this box is not ticked, the channels of the audio signal will be played on each way of the loudspeaker.

🕮 The cursor of a time history plot is synchronised with the playback of an audio recording over the part of the audio file visible on screen:

- If a spectrum view is associated, the spectrum changes simultaneously.
- If cursors are synchronised for all views, they all move at the same time.

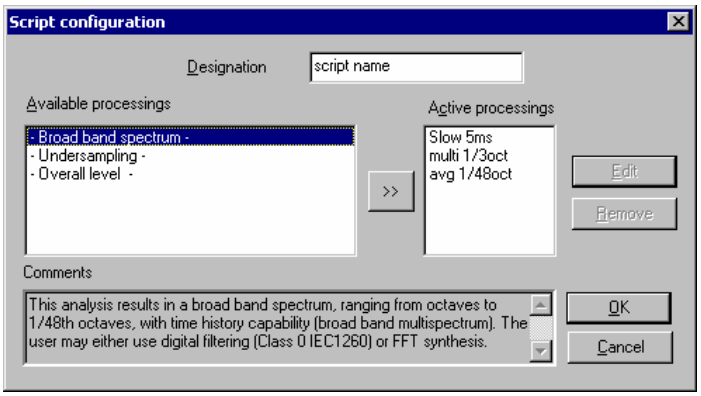
4.5. Analysis of an audio record / Aux. menu

The user may analyse audio records in both time and frequency domains, according to user defined parameters, directly from a time history plot.

4.5.1. Analysis configuration (options)

Use the command **Aux. / Frequency analysis and advanced processing / Configure** to define the parameters of the audio record analyses. The script configuration dialog box is displayed on screen.

The analysis types are:



- **Average spectrum** in octaves and third octaves
- **Average spectrum** in 1/6, 1/12, 1/24 or 1/48 octaves **(option).**
- **multispectrum** in 1/Nth octave (spectrum time history and A, Lin global levels calculation) **(option)**
- **Detailed time history** (A, C and Lin parallel, several time constants - Fast, Slow, Impulse, etc. – using very small time step) **(option)**

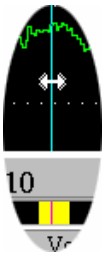
- **Decimation** (undersampling) or deletion of audio records to optimise audio storage capacity on the PC hard disk.
- **Gain optimisation** results in amplification the time signal NAC data in order to allow for a better listening level.

For each type of processing, click on the Edit button to define the parameters of the analysis. Once the script is launched, and the audio files selected, each analysis will be carried out sequentially and automatically.

📖 *The configuration and operating process of audio record analyses are dealt with in **chapter 14.***

4.5.2. Run analyses

Audio record analyses can be run in **dBTRAIT32** by different means:



- **Directly from the time history plot display, with a cursor**

To do so, display the audio bar by clicking on the icon . It is then displayed below the plot. Move the cursor on the audio event to analyse as shown.

Click on the icon . The audio signal is then processed by the script server in the background, and according to the configuration parameters.

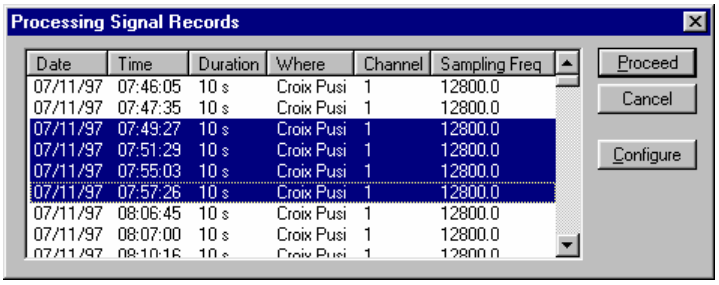
📖 *If the active cursor is not placed on an audio event, the processing button cannot be accessed.*

When the audio records have been processed, an event corresponding to the type of analysis is created in the corresponding information bar.

If, for example, audio records' analyses result in a third octave averaged spectrum and a third octave multispectrum, the corresponding events are shown in the information bars, below the audio event that was analysed.

- **From the Aux. menu of dBTRAIT32**.

Audio records can also be processed as soon as a CMG datafile is opened.

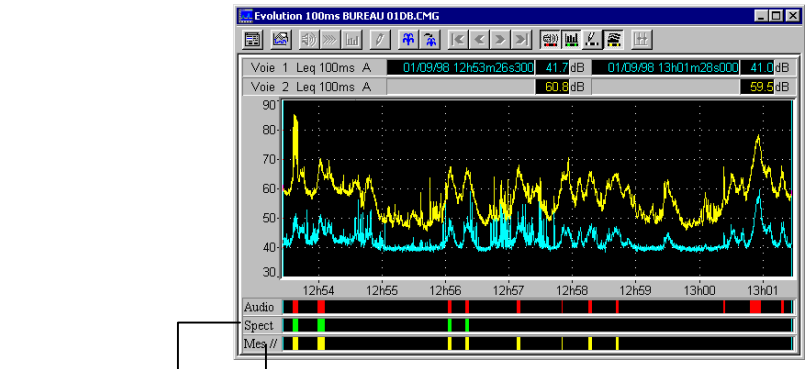


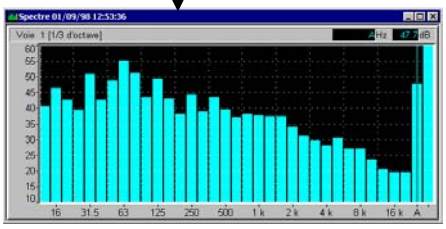
To do so, click on the key in the main **dBTRAIT32** toolbar or use the command **Aux. / Frequency analysis and advanced processing / Run.** If more than one audio file has been recorded, a dialog box is displayed (see aside) that allows the user to choose which audio records should be processed.

The key **Configure** accesses the analysis configuration dialog box. Once the audio records have been selected in the list, click on the **Proceed** key to start the analysis.

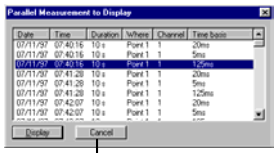
4.6. Display audio record analysis results / Time history menu

The results of the audio records' analyses can be directly accessed on the time history plot by a double click on the corresponding event or by using the **Time History / Display** commands. These results are otherwise accessible through the commands of the Aux. menu.

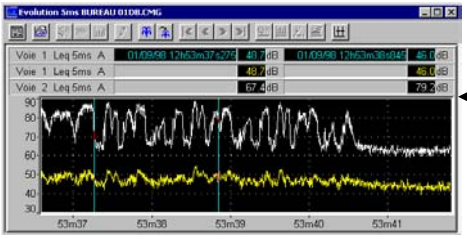




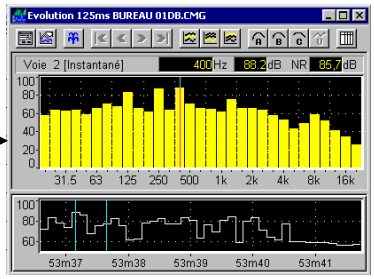
A double click on a **Spectrum** event displays an averaged spectrum in 1/N octave bands.



Dialog box displayed to select the Parallel measurement events (multispectra and /or detailed time histories)



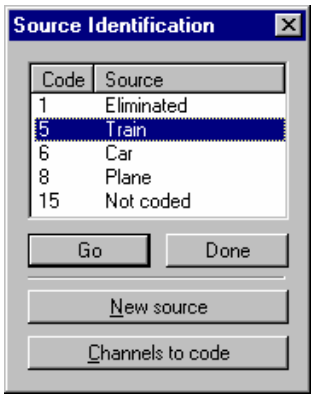
Display a detailed time history



Display the time history per frequency band (multispectrum)

4.7. Coding a noise source / Time history menu

It is possible to identify noise events by coding data on the time history plot by using the command or **Time history / Source between cursors.**



To do so, click on the icon . The dialog box shown aside appears on screen. There are two possibilities:

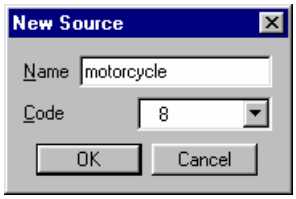
- **The noise data to code corresponds to an existing noise source, already defined in the software**.

Place the cursors on a time portion of the plot then select in the **source** list a given source type and press the **Go** key. The data in between the cursors on the time history plot is then coded.

Proceed similarly to code other noise sources.

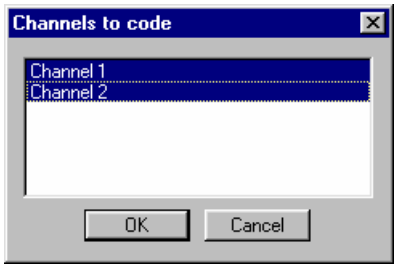
- **The noise data to code corresponds to a new noise source, not yet defined in the software.**

Click on the key **New source.** The dialog box shown opposite appears on-screen. Give a **name** and a **code** number to the new source and validate.



Then place the cursors on a time portion of the plot then select in the **source** list a given source type and press the **Go** key. The data in between the cursors on the time history plot is then coded.

🕮 *The code with the lowest number has priority to the others.*
Select a lower number, in order to code a source "over" the existing source (the code column shows the existing codes).



Noise source coding can be applied to one or several measurement channels. Click on the key **Channel(s) to code** and select the appropriate channels.

The command or **Time history / Next appearance** can be used to find the next appearance of the same type of noise source on the time history plot. Two possibilities may occur:

- If a cursor is located on an existing noise event, **dBTRAIT32** then place the cursor at the start of the next appearance of the source.
- If the cursor is not located on a noise event, a dialog box is displayed for the operator to choose which type of noise source should be searched for.

🕮 *More information on coding noise events in **dBTRAIT32** can be found in **chapter 6.***

4.8. Search for Max level

The Max level can be searched for the type of parameters displayed in the time history plot:

Max search on the display area

Search rules are as follows:

- Max search is performed on the type of magnitude displayed in the time history plot (**icon is disabled if two magnitudes are displayed**)
- Search for the maximum value(s) (0.1 dB tolerance)
- Circular displacement on all values. Search is always carried out starting from the left cursor (which may eventually become the right cursor)
- In case of a spectrum view, spectrum at the cursor will be displayed.

Max search on the entire file

The same rules apply, except that the display will automatically move to the max area.

Max calculation can only be performed on a **basic period view**. If a recomposed Leq is displayed, then Max search buttons will be disabled (to change the display time basis, see § 4.1).).

5. SPECTRAL TIME HISTORY PLOT (MULTISPECTRUM)

The spectral time history plot is one of the main plots available in **dBTRAIT32.** It represents a plot of sound levels in dB per frequency band (calculated according to a user-defined time base) as a function of time. These sound levels are calculated for each octave or third octave frequency bands of the acquired spectrum (from a **SYMPHONIE** or **JAZZ** acquisition system with the **dBTRIG32** software). For each frequency band, we can therefore display a time history. Such plot gives an overview of a noise climate for a given environment, with frequency domain information.

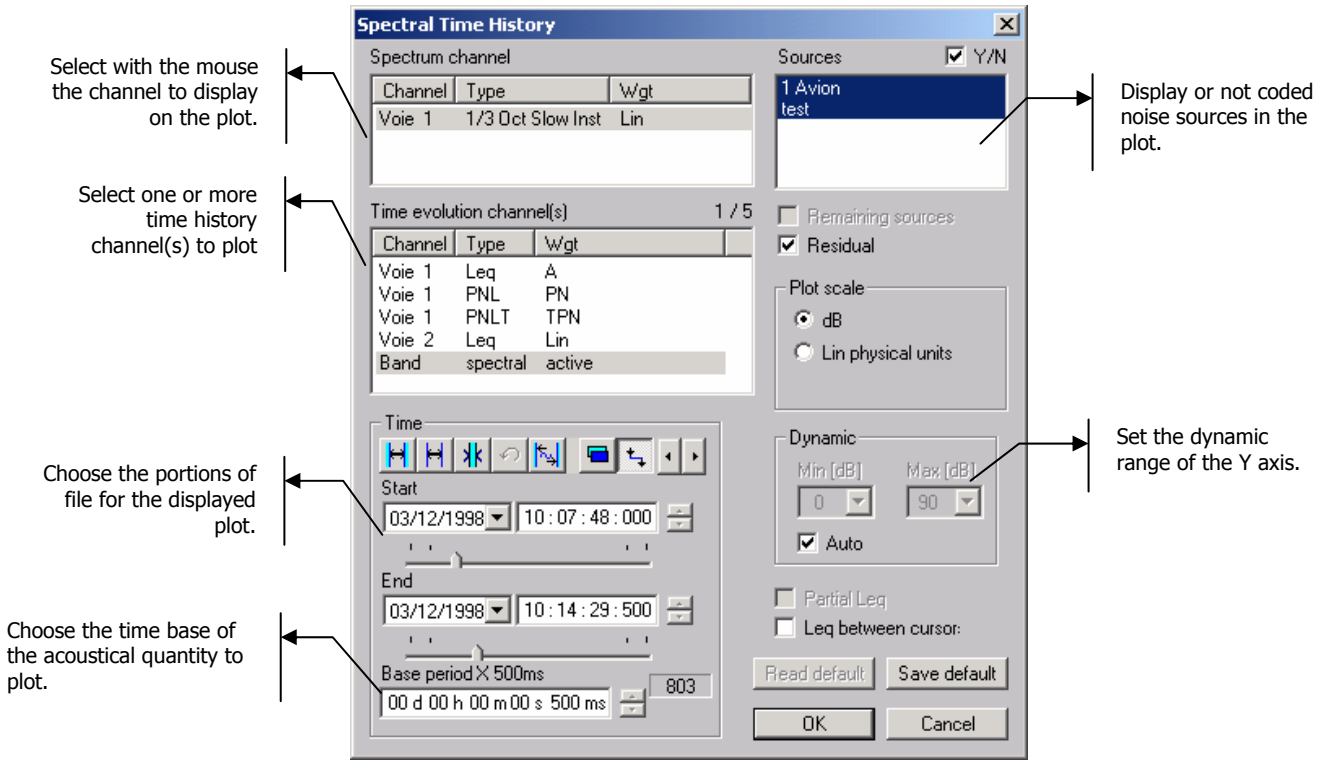
The spectral time history plot may or may not display existing noise events. In this case, the noise sources will be displayed with different colours on the plot.

Audio records can be played back through the sound system of the computer directly form multispectrum plot. Averaged, minimum and maximum spectra, A, B or C weighted, can be directly displayed on the plot as well.

📖 *Such plot is only accessible for measurement datafiles taken with the **SYMPHONIE** or **JAZZ** system and the **dBTRIG32** software, and the sound level **SIP95** with the **real time** module. These instruments allow the user to acquire octave and third octave spectra simultaneously to other acoustical quantities (Slow, Fast, Impulse, Peak, and Short Leq). It may also be the result of a multispectrum analysis of an audio record with the script server utility.*

5.1. Configuration parameters of the plot

Once a measurement datafile is opened, click on the icon or use the command **Display / Spectral time history** to plot the multispectrum in the CMG datafile. The following dialog box is displayed on screen. Define the parameters of the plot. On validation of this dialog box, the spectral time history plot will be displayed in a new window.



The following parameters may be defined:

- **Spectral channel**

The measurement channel to plot. Select a measurement channel corresponding to a frequency band.

- **Time history channel(s)**

Select time channel(s) to plot. The user can be used at the same time with the time history plot of the current band. It is used to compare the time history for a frequency band (selected on the spectrum history) with the global time history.
There is the possibility to draw 6 time histories simultaneously (or 5, if the current band has been chosen).

- **Timetable**

Specify the beginning and ending time of the file section to plot (the format of this selection is **hh:mm:ss:ms dd/mm/yy**) or the beginning time and the length of the section to take into account.

Icons are used to, respectively:

- Select the entire file (i.e., data over the total length of the file)
- Select the entire channel (i.e., data over the total time length of the channel)
- Select data between cursors placed on the plot
- Go back to original times
- Round up times (rounding calculation depends on the total duration of display)
- Select whether to display ending time or duration
- Link starting and ending cursors

- **Base plot step**

The plot may be displayed using the default time base of the acoustical quantities in the datafile or a greater time base.

During acquisition, an elementary time base has been used to store the short Leq data (usually 125ms or 1s). It is possible to recalculate noise levels according to a greater time base (for example 15-min) that is a multiple of the default integration time. **dBTRAIT32** adjusts automatically the base plot step to the nearest value that matches an elementary time base multiple.

Similarly, it is not possible to recalculate noise indicators according to a step that is smaller than the acquisition time base.

- **Sources / Remaining sources / Background noise**

Select in a list the noise sources to consider (or not) for the plot. If one wish to display noise sources (box **Y/N** ticked) on the plot, they will be shown in different colours in order to differentiate them from the rest of the data.

The option **Remaining sources** allows the user to plot all sources that have not been selected, except the background noise, as a single source named "remaining sources". This option may be useful to estimate the contribution of a source compared to all the other sources, for instance. The selection will be recalled as default value next time such a command is used.

The option **Background noise** allows the user to represent all the noise data in the file that have not been coded as a specific noise source called "background noise". The selection will be recalled as default value next time such a command is used.

- **Dynamic range**

Select the minimum and maximum values of the Y-axis in dB for the plot. On validation, these parameters will be applied to the plot. To automatically adjust these values, tick the box **Auto.**

- **Plot active frequency band**

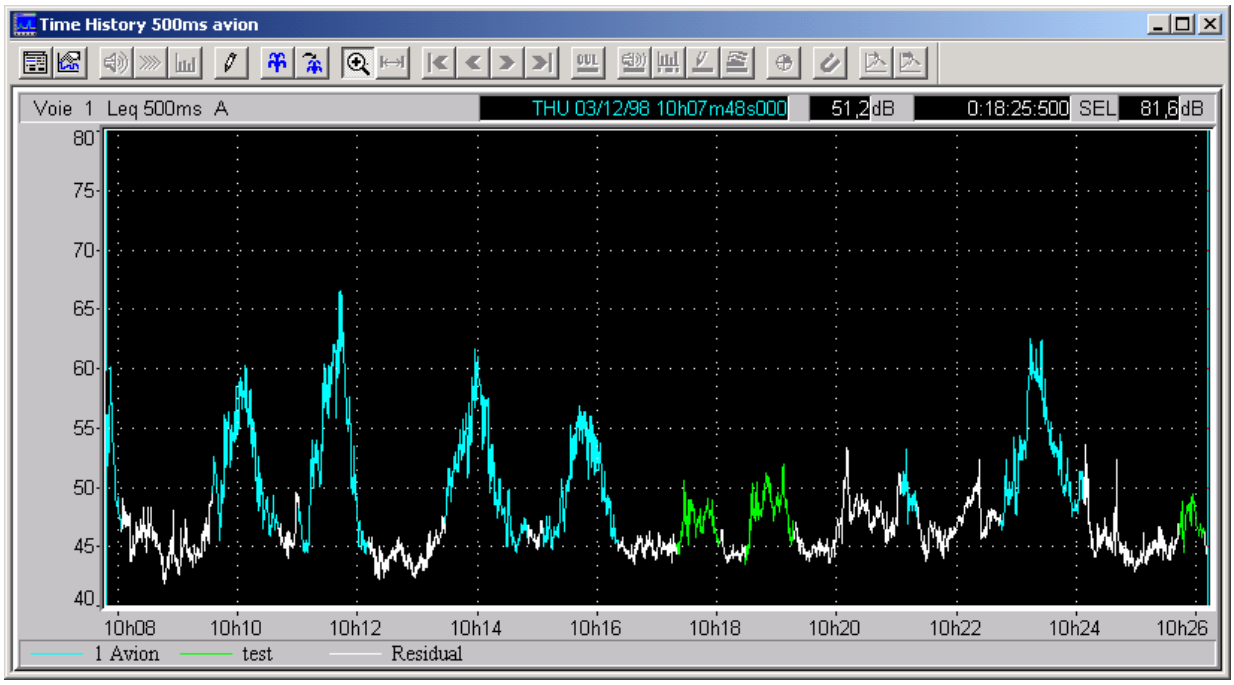
Select this option to automatically plot the time history of the frequency band selected with the cursor on the spectrum plot. If this option is not ticked, the plotted time history will not be adjusted when a different frequency band is selected on the plot.

- **Leq between cursors**

This option allows the user to calculate the equivalent sound pressure level corresponding to the time portion in between the cursors of the time history plot. This value is displayed on the time history plot.

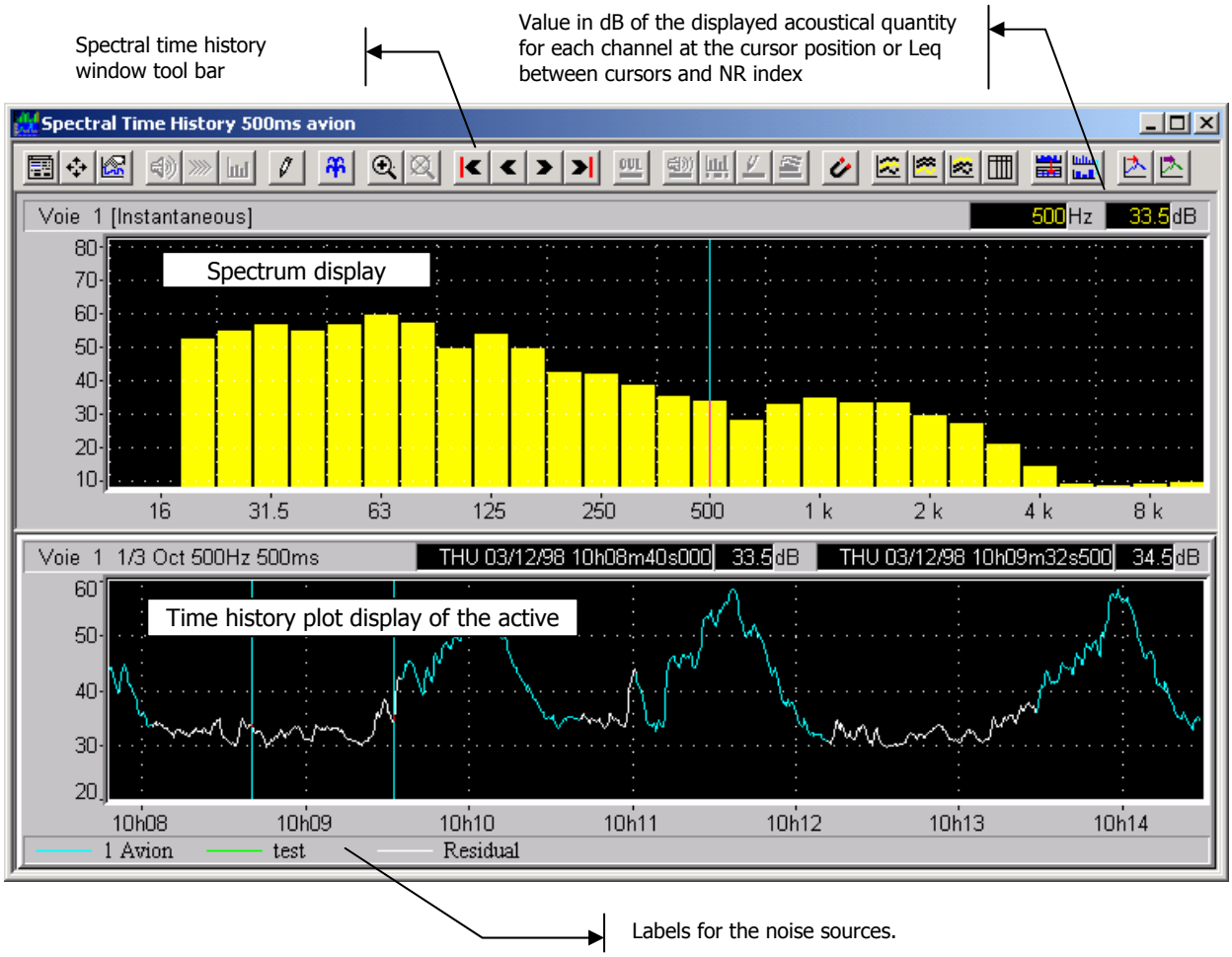
- If this value is not checked, the dB value of the acoustic magnitude is given for each cursor position on the time history plot.

- If this value is checked, the following default parameters will be displayed:
  - Date for left cursor
  - Average Leq between cursors
  - Time length between cursors
  - SEL value between cursors (SEL calculated over the entire section between cursors does not take Max – 10 into account).



To display the date for the 2nd cursor, one needs to modify the dBtrait.ini file and set *ShowDuration* to 0 in the [Settings] section.

5.2. Spectral time history plot display



The spectral time history plot window features a tool bar that gives access to functions such as coding a noise source between cursors, calculations of averaged, minimum and maximum spectra, calculations of A, B or C weighted spectra, etc.

5.3. Spectral time history plot toolbar / Graph menu

Set plot parameters

Set display parameters

Playback of audio file corresponding to cursor position

Analysis of audio file corresponding to cursor position

Display spectrum corresponding to cursor position

Edit comment between cursor positions

Coding of noise source between cursors

Zoom in on section of time history between cursors

End of zoom. Back to previous view

Show first section of file

Show previous section of file

Show next section of file

Show last section of file

Show / Hide Overload bar

Show / Hide Audio bar

Show / Hide Spectrum bar

Show / Hide Comments bar

Show / Hide Parallel Measurements bar (magnitudes vary with time)

Link cursors

Calculate and display average spectrum between cursor (central plot in yellow)

Calculate and display minimum spectrum between cursors (bottom plot in yellow)

List values for spectrum on display

Add displayed spectrum to list of global items

Convert displayed spectrum into octave spectrum

Search for Max level in current view

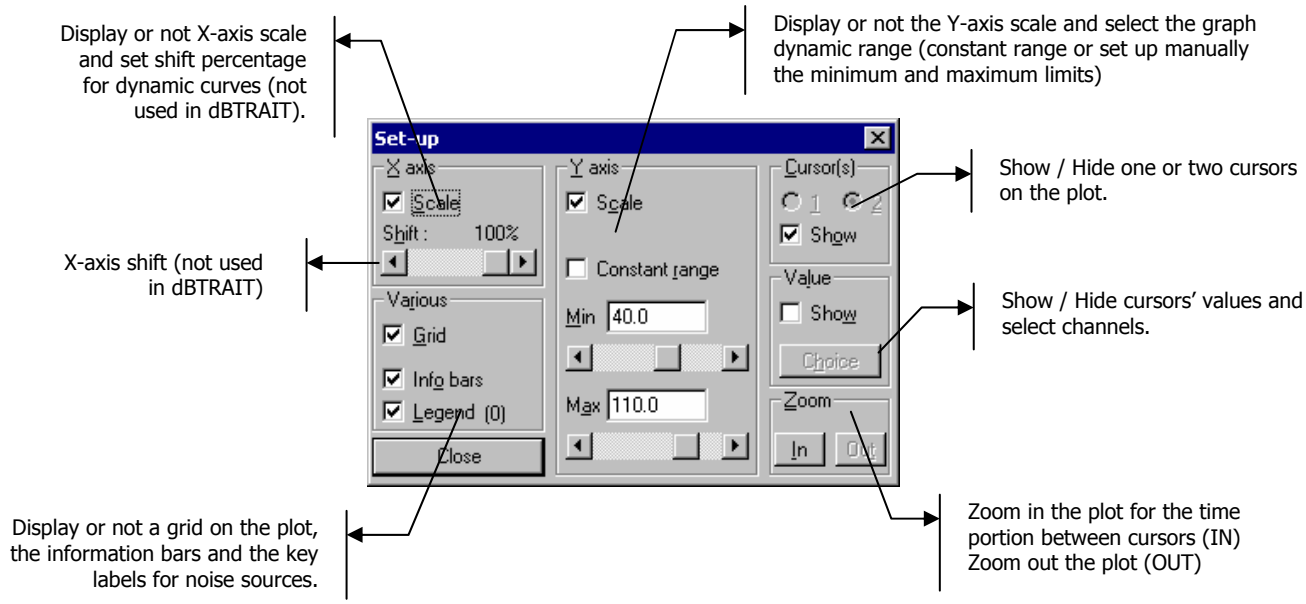
Search for Max level over entire file

These commands are also accessible by the **Graph** menu (activated when the active window is a spectral time history) or by clicking on the spectral time history with the right mouse button.

5.3.1. Set-up graphical display parameters

Set-up the graphical display parameters by clicking on the icon or by using the command **Spectral Graph / Configure plot.**

The plot is updated immediately when a modification is made. Each plot has its own settings' dialog box: a modification on one plot does not affect the settings of another plot.


Display or not X-axis scale and set shift percentage for dynamic curves (not used in dBTRAIT).
Display or not the Y-axis scale and select the graph dynamic range (constant range or set up manually the minimum and maximum limits)
Set-up
X axis
Scale
Shift : 100%
Y axis
Scale
Constant range
Min 40.0
Max 110.0
Cursor(s)
1
2
Show
Value
Show
Choice
Zoom
In
Out
Various
Grid
Info bars
Legend (0)
Close
Show / Hide one or two cursors on the plot.
X-axis shift (not used in dBTRAIT)
Show / Hide cursors' values and select channels.
Display or not a grid on the plot, the information bars and the key labels for noise sources.
Zoom in the plot for the time portion between cursors (IN)
Zoom out the plot (OUT)

5.3.2. Display noise data by time portions

It is possible to navigate from a time section of the data file to another by using the icons or the commands **Graph / File start ; Previous section ; Next section ; File end** if the time history plot display does not cover the complete duration of the datafile.

Example: For a 24-hour measurement file (starting at 08:00am and ending at 08:00am the next day), the operator display a time history plot for the time portion starting at 16:00 and ending at 17:00:

Click on the icon to display the next time portion of the plot 17:00 – 18:00, then

Click on the icon to display the last time portion of the plot 07:00 – 08:00, then

Click on the icon to display the previous time portion of the plot 06:00 – 07:00, then

Click on the icon to display the first time portion of the plot 08:00 – 09:00.

📖 *If the complete file is displayed on the plot, the time portion icons cannot be accessed (greyed).*

5.3.3. Playback an audio record / Aux. menu.

When audio signals have been recorded at the time of acquisition, it is possible to play them back through the computer sound system. Audio replay can be achieved from the **Aux.** menu of **dBTRAIT32**.

To do so, click on the icon or use the command **Aux. / Audio / Replay.** If more than one audio files have been recorded, a dialog box is displayed allowing the user to choose the audio record to play back. After selection, click on **Play** to listen to it on the computer sound system.

5.4. Operations on the spectral time history / Graph menu

From the spectral time history plot window, several calculation and display operations can be performed.

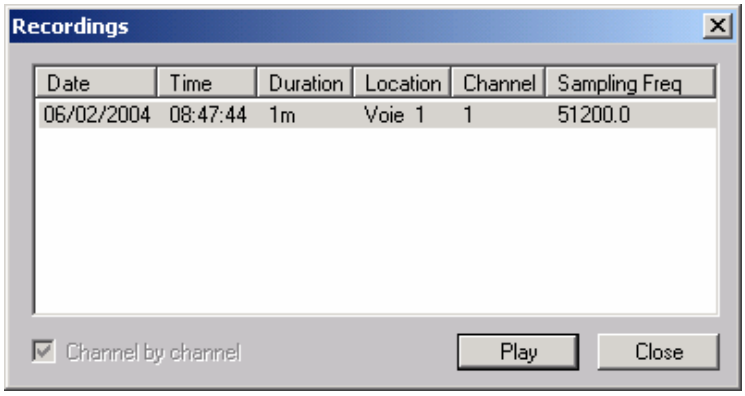
5.4.1. Interactions between spectrum and time history plot

When moving the cursor on the instantaneous spectrum plot (upper part of the window), the time history of the corresponding frequency band is automatically displayed in the lower part of the window – if the option **Plot active frequency band** has been selected in the display parameters.

When moving a cursor on the time history of a frequency band (lower part of the window), the instantaneous spectrum is shown for this cursor position.

5.4.2. Maximum, minimum and averaged spectra

With the icons , and (corresponding respectively to the commands **Graph / Averaged spectrum, minimum spectrum** and **maximum spectrum**), it is possible to replace the instantaneous spectrum by the averaged, minimum or maximum spectra, calculated for the time portion in between the cursors.



The **averaged spectrum** corresponds to the average of all instantaneous spectra between the cursors.

The **minimum spectrum** corresponds to the minimum values of the short Leqs for the considered time periods (between cursors). For each frequency band, the minimum value is calculated. The minimum spectrum therefore corresponds to the minima of the frequency bands.

The **maximum spectrum** corresponds to the maximum values of the short Leqs for the considered time periods (between cursors). For each frequency band, the maximum value is calculated. The maximum spectrum therefore corresponds to the maxima of the frequency bands.

5.5. Listing spectra values between cursors

With the command **Graph / list spectra**, it is possible to list the values of the displayed spectrum in a results table or as graphics.

📖 *For further information on this type of listing, see the **paragraphs 8.1** and **8.3.***

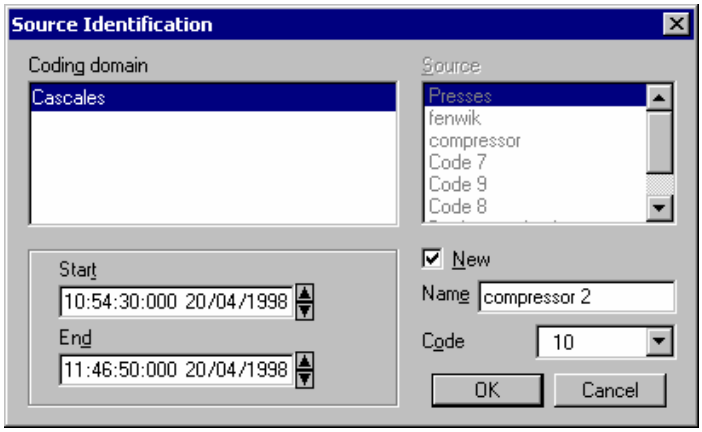
5.6. Coding a noise source / Graph menu

It is possible to identify noise events by coding data on the time history plot by using the command or **Graph / Source between cursors.**

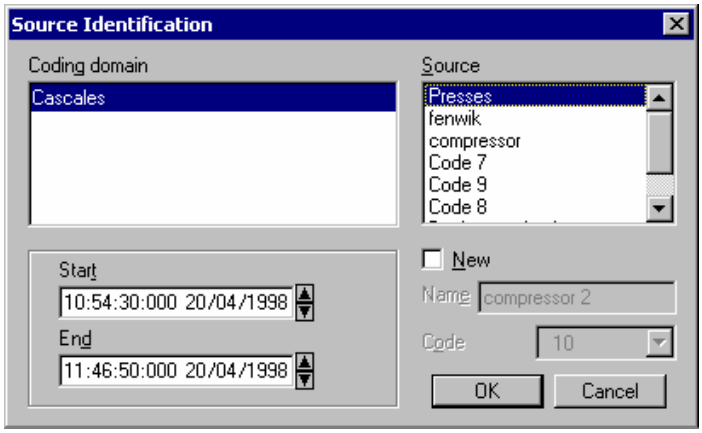
To do so, place the cursors on a time portion of the plot then click on the icon . The following dialog box appears on screen.

There are two possibilities:

- The noise data to code corresponds to a new noise source, not yet defined in the software. Tick the box **New** and give a **name** and a **code** number to the source.



- The noise data to code corresponds to an existing noise source, already defined in the software. Uncheck the box **New** and select in the **source** list a source type



Noise source coding can be applied to one or several measurement channels. In the field Channel(s) to code, select the appropriate channels.

📖 *More information on coding noise events in **dBTRAIT32** can be found in **chapter 6.***

5.7. Search for Max level

The Max level can be searched for the type of parameters displayed in the time history plot:

Max search on the display area

Search rules are as follows:

- Max search is performed on the type of magnitude displayed in the time history plot (**icon is disabled if two magnitudes are displayed**)
- Search for the maximum value(s) (0.1 dB tolerance)
- Circular displacement on all values. Search is always carried out starting from the left cursor (which may eventually become the right cursor)
- In case of a spectrum view, spectrum at the cursor will be displayed.

Max search on the entire file

The same rules apply, except that the display will automatically move to the max area.

Max calculation can only be performed on a **basic period view**. If a recomposed Leq is displayed, then Max search buttons will be disabled (to change the display time basis, § 4.1).

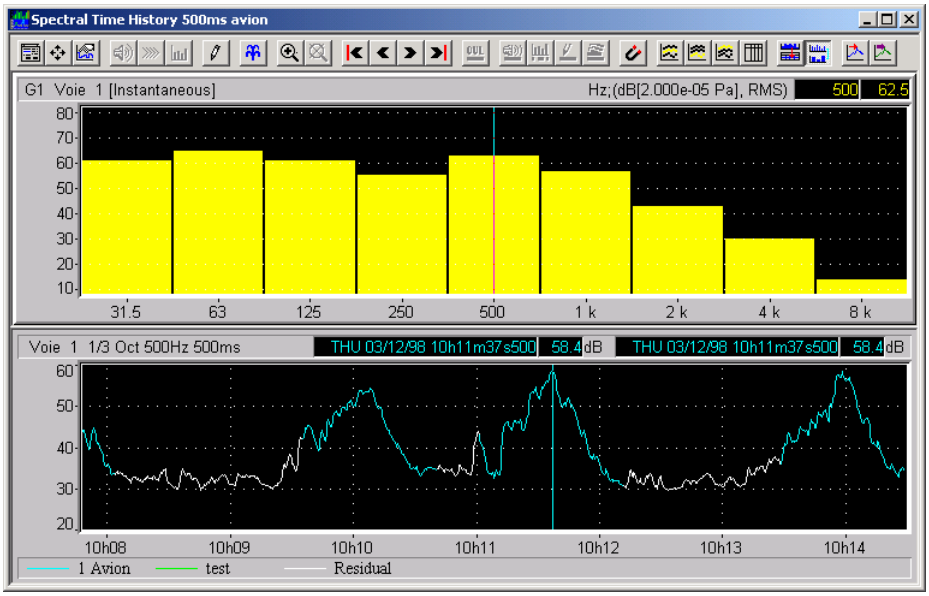
5.8. Adding a spectrum

Button is used to add the displayed spectrum to the list of global items. This list is used to perform various calculations on spectra (see Chapter 5 for more details on this function).

5.9. Octave band conversion

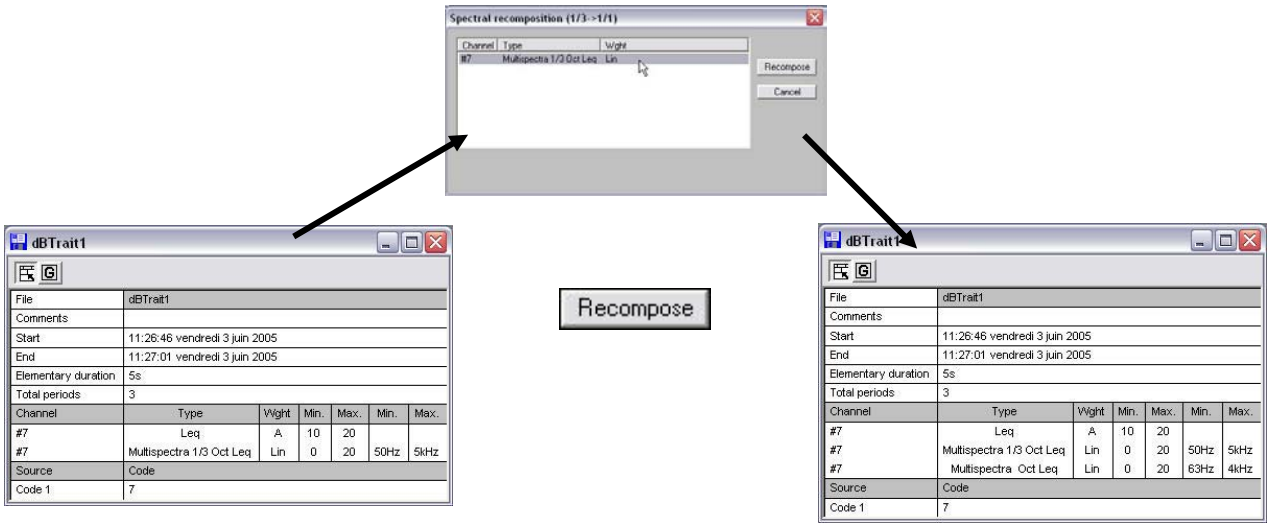
5.9.1. Spectrum conversion

Click on to convert the current spectrum into an octave spectrum. This function performs a temporary conversion only of the current spectrum.



The corresponding spectrum can be added to the list of global items and the conversion into octave spectrum can be launched from this specific view in order to keep the save the converted spectrum.

5.9.2. Multispectra conversion



6. IDENTIFICATION OF NOISE SOURCES

dBTRAIT32 can be used to identify sources in order to calculate their contribution to the overall noise level and to perform analysis according to various regulations. The identification process is achieved by coding techniques specific to the software. On top of coding at the acquisition stage, **dBTRAIT32** features three different type of coding techniques:

- **Coding using cursors (from a time history plot)**
  A time condition is used to code a source on a time portion of the data. This command is activated only for time history plot display. The time section to code is the one in between the cursors on the time history plot.

- **Coding within known time limits (Source menu)**
  A time condition is defined to code a noise source on a time portion of the data.

- **Coding using a threshold (Source menu)**
  A threshold condition, with or without an additional time condition, is applied to identify data as a specific noise source.

Use these commands to define noise events and identify a portion of the data as a specific source. A name and a code number designate a noise source.

6.1. Advantages of coding

The source identification commands are powerful tools of **dBTRIG32** and **dBTRAIT32** (some elements are also available in the program for data transfer of sound level meters such as the **SIP95**). The source identification (on-line and/or off-line) allows the user to define very precisely the time portions of the measurement where noise events appear.

When processing measurement results, the source identification process allows the user to calculate noise indicators specific to a noise event, and compare it to overall levels.

- **Coding during acquisition (on-line)**

In the **dBTRIG32** acquisition software, on-line source identification is possible by pressing the function keys corresponding to the code number of the noise source (F4 for source code number 4, etc.) or the related icon of the horizontal toolbar. The source identification is enabled until the same code key is pressed or another noise source is enabled.

📖 *Consult **dBTRIG32** user manual for further information on the on-line source identification process. Consult the **SIP95** user manual for further information of coding at acquisition.*

Note that for the expert module of **dBTRIG32**, it is also possible to perform simultaneous coding of noise sources.

- **Coding during processing (off-line)**

The first step of the off-line source identification process is to define a noise source. A source is defined by its identifier (a string of characters) and an internal identifier (its code number). The code number is a unique number between 1 and 15. Some of these codes are pre-set and cannot be modified.

After defining the source, select a time portion of the measurement and code it as a specific noise source. The identification itself follows precise rules and may be performed using various methods (cursors, known time limits, threshold, etc.).

When sources are identified, the following indicators may be calculated for each noise source:

Tables	*Graphics*
Particular Leq Partial Leq SEL, LMIN, LMAX Counting sources' appearances Contribution of sources to overall noise level	Time history Statistical distribution

6.2. Source identification techniques

We describe in this paragraph the principles and the techniques used in 01dB programs to identify a noise source.

6.2.1. Time condition

The noise source is defined by time limits (start and end).

This may be used to identify a source whose appearances are known (***Source / Identifying using time condition***) or from a time history display (***Time history or Graph / source between cursors***). In the latter case the start and end times read automatically at cursors' positions.

The "Identify" icon of the time history plot toolbar provides direct access to source identification using a time condition between cursors.

6.2.2. Threshold condition

The threshold condition provides **automatic** identification of the multiple appearances of a given noise source. The data to code (Short Leqs of the overall noise level or a frequency band, time weighted levels) corresponds to noise levels between minimum and maximum user-defined thresholds. Two criteria that are more sophisticated may also help to make the threshold coding more precise. Firstly, use a condition that set the duration of each source appearance. Secondly, an extension before and after the threshold may be required, usually for moving sources (getting closer and going away).

🕮 *Example 1: a car is usually defined by a minimum threshold of 60 dB, a maximum threshold of 80 dB, a minimum event duration of 1 second and a maximum event duration of 10 seconds.*

🕮 *Example 2: a plane may fly over the site where the car noise from the previous example is measured. It may happen that the noise level of the plane is similar to the average level of cars' passing by, and the same minimum threshold of 60-dB and maximum threshold of 80 dB should be used for source identification. Different duration limits may be set to distinguish the two sources (minimum event duration of 30 second for planes can be used for example).*

Coding using a threshold condition is the most performing source identification technique as the user defines the Leq pattern (minimum and maximum levels and duration) of a source but it requires a good knowledge of the coding principles. We recommend this method for advanced users.

Once the source identification criteria have been defined, noise data that fulfils the conditions are affected to a given noise source, according to a priority rule based on the code number.

6.2.3. Definitions of code numbers

The code number of a source is the unique internal identifier of a defined noise event. It varies between 1 and 15. Each elemental time period, of each measurement channel independently, may have a different associated code number. The following list describe the code numbers:

- **Code 1 : Eliminated**

Any data coded with code 1 will not be taken into account for post-processing functions, and data plots. This code eliminates external annoyances, which have nothing to do with the noise environment to study (for example, ones can eliminate from a measurement the noise made by the operator or a third party).

📖 *During acquisition, the software associates code 1 to the measured short Leq data in pause mode. The corresponding time portion will be coded as eliminated in the datafile, and will therefore be ignored for any subsequent post-processing operations.*

- **Code 2 : Overload**

This code is generated automatically during measurement or data transfer. All Leqs coded 2 should usually not be taken into account in calculations (assimilated to code 1), as the recorded values were not within the linearity range of the instrument, at the time of acquisition.

- **Code 3 : Underload**

This code is generated automatically during measurement. All Leqs coded 3 should usually not be taken into account in calculations (assimilated to code 1) as the recorded values were out of the linearity range of the instrument, at the time of acquisition.

- **Codes 4 to 14 : Noise sources**

These codes are available to code up to 10 different noise events. At the time of acquisition, on-line coding may be performed from code 4 to code 9.

- **Code 15 :Background**

When no source is specified, the background noise (code number 15) is applied. This is the default code for the noise data.

💣 **Warning: The priority rule may be transgressed for explicit coding with this number.**

💣 **The codes 1 (Eliminated), 2 (Overload), 3 (Underload) and 15 (Background) are pre-set and the values are automatically coded when creating the CMG data file if necessary.**

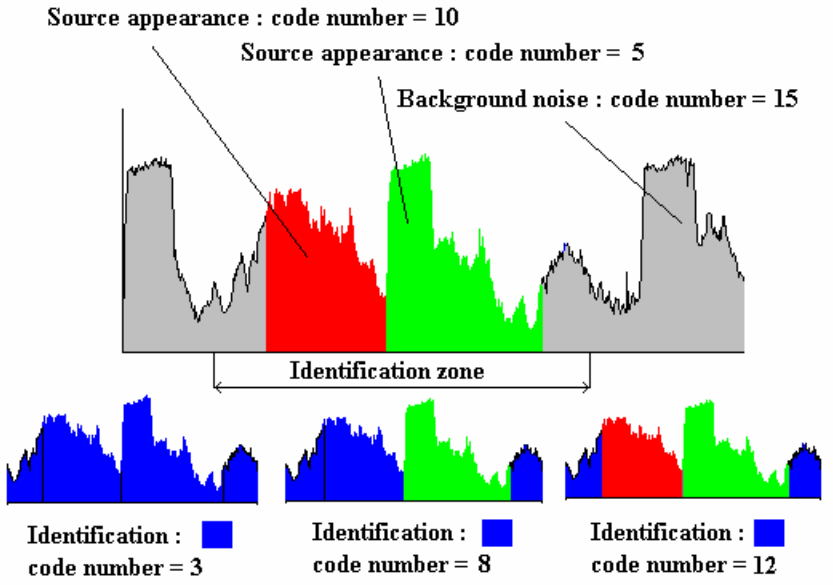
6.2.4. Code number priority rule

The short Leq method assigns a source code to each elemental time period. Each source is identified by its code (a number between 1 and 15). If there is no source identified, the data is considered as a source type 'background'. Only one source may be associated with each time portion. The priority rule has been introduced to manage complex noise situations when two or more sources are active at the same time.

This rule is based on the postulate that a unique code is associated with a source. The code number is defined either automatically or by the user. When a coding operation is running, **dBTRAIT32** may face a particular situation when the user is requested to code a new source and that a previously existing source had already been associated to the same time portion. The priority rule solves the ambiguity: **the source with a lower code number has priority over a source with a higher code**. If the old source has priority (lower code), no coding will be done at this time moment. If the new source has priority, it will replace the old one at this time moment.

Some code numbers are reserved. The code 15 (highest possible) is reserved for background noise. Any new source will have a lower code, and thus have priority over background noise. The code 1 is reserved for the eliminated periods. A time period coded with code 1 is eliminated from all subsequent operations (plots, listings, and calculations). The code 2 is often used for overload, and the code 3 for underload coding.

Example: Consider a time portion of a source appearance (code 8) that the user wishes to assign to another source. It will only be possible if the current source code number is lower (less than 8). In this case, the previous source appearance will be split into 2 noise events separated by the new source appearance. Otherwise (code greater than 8), the previous source appearance will remain unchanged.


Source appearance : code number = 10
Source appearance : code number = 5
Background noise : code number = 15
Identification zone
Identification : code number = 3
Identification : code number = 8
Identification : code number = 12

The example above shows the importance of the source code number when identifying a noise source. Depending upon the source code number, the result of identification may change and lead to different calculation results.

📖 *At the time of processing, when deleting a noise source, all data attached to the current source are assigned to the background noise, as it is not possible to restore the previous source identification.* ***Therefore, we recommend being very careful when coding sources, as this operation is irreversible.***

📖 *The priority rule is not respected when the operator re-code part of the data with the source "background" (code 15). In this case only, existing codes will be deleted and overwritten.*

With **dBTRIG32 expert module**, it is possible to code simultaneously noise data. In this case, the priority rule is still valid but the data coded with a higher code number will be overwritten.

If, for example, the data that lies within the identification zone in the above example are coded with the numbers 10 and 5 simultaneously, and that the user delete the code 5, the noise data will still be coded with the code 10.

6.3. Coding commands in dBTRAIT32

Let us now describe each coding commands of **dBTRAIT32**.

6.3.1. Source between cursors / Graph or Time history menus

It is possible to identify noise events by coding data on a time history plot by using the command or **Time history / Source between cursors** and **Graph / Source between cursors** for a spectral time history plot.

The command or **Time history / Next appearance** can be used to find the next appearance of the same type of noise source on the time history plot.

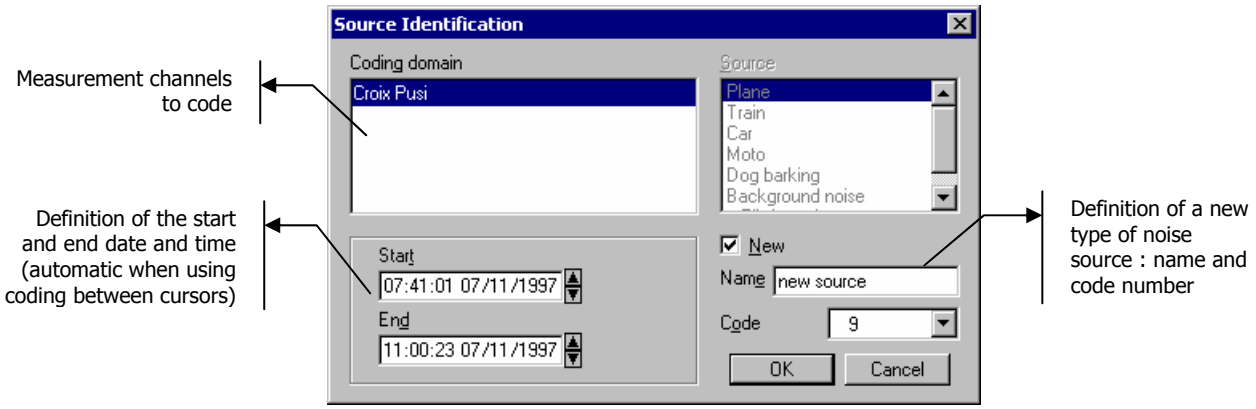
📖 *For further information on coding sources from a plot, consult the **paragraphs 4.7 and 5.6**.*

6.3.2. Identifying using time condition / Source menu

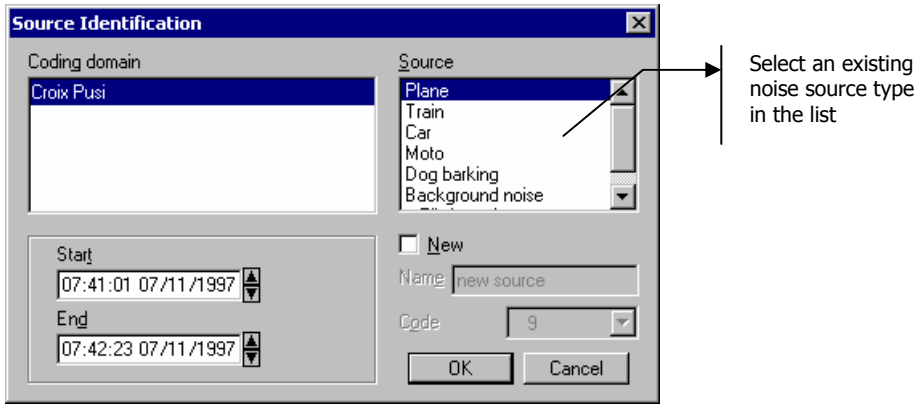
Use the command **Source / Identifying using time condition** to define the parameters of the source identification process using a time condition. The only difference with the 'source between cursors' command is that the time parameters (start and end) are not defined by the cursors' position on the plot.

There are two possibilities:

- The noise data to code corresponds to a new noise source, not yet defined in the software. Tick the **New** box and give a **name** and a **code** number to the source.



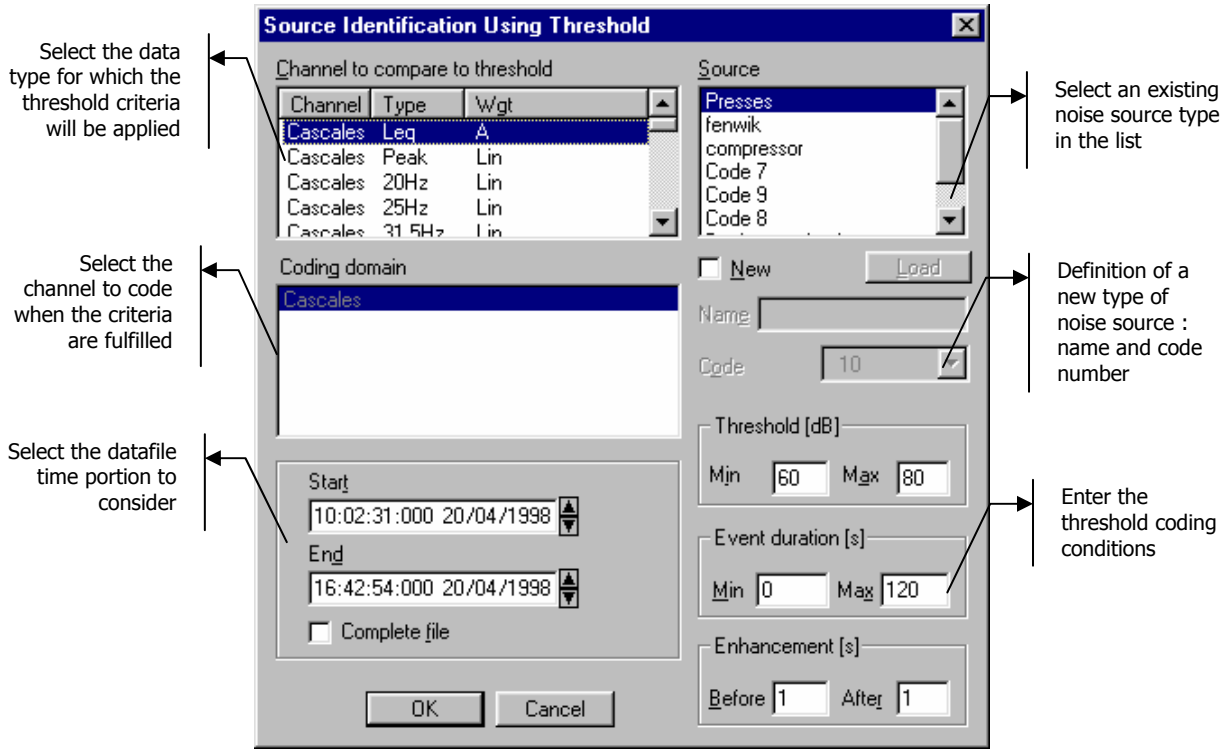
- The noise data to code corresponds to an existing noise source, already defined in the software. Uncheck the **New** box and select in the **source** list a source type.



Noise source coding can be applied to one or several measurement channels. In the field **Channel(s) to code**, select the appropriate channels.

6.3.3. Identifying using threshold condition / Source menu

Use the command **Source / Identifying using threshold condition** to define the parameters of the source identification process using a threshold condition. To illustrate threshold coding, let consider the example of a car. A minimum threshold of 60 dB, a maximum threshold of 80 dB, minimum event duration of 1 second and maximum event duration of 10 seconds usually defines a car pattern.



First, select the **channel to compare to the threshold** conditions. The software will scan through the data contained in this channel and look for a time portion that fulfils the threshold criteria. In the field **Coding domain,** select all the measurement channels for which the data will be coded when the threshold conditions are fulfilled. It is possible to define a **new** type of noise source or to select an existing type of **source** in a list as before. It is also possible to **load** noise sources that have been previously defined in a different file (sources' information in the file **sources.ini**)

The threshold coding technique of **dBTRAIT32** obeys to three criteria (or conditions):

- **Threshold conditions (Threshold field)**

Define the minimum and maximum levels in dB for the type of source to identify. In our example, select 60dB as minimum and 80 dB as maximum levels. All noise levels in the datafile that are contained in the range 60dB to 80dB will meet this first requirement.

- **Duration conditions (Event duration field)**

Define the minimum and maximum event duration in seconds for the type of source to identify. In our example, select 1s as minimum duration and 10s as maximum duration All noise levels in the datafile that fits in the range 60dB to 80dB and that lasts for 1s at least and 10s at most will meet the requirements.

- **Enhancement conditions (Enhancement field)**

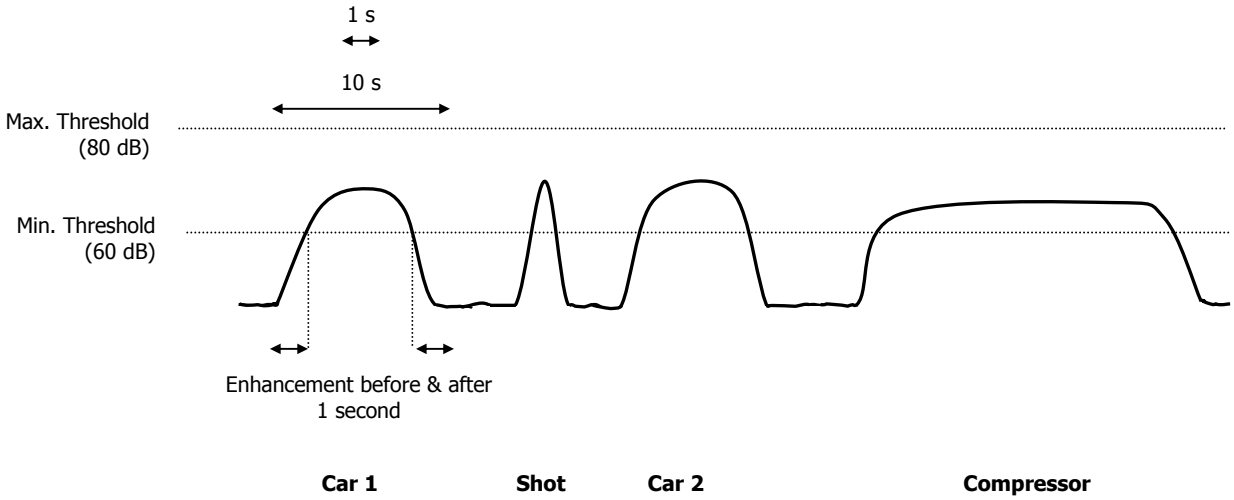
In order to extend the noise data coded according to the above conditions; define the enhancement duration before and after the coded noise event. In our example, for a car passing-by, the time portion of data coded, as a *Car* noise source will be extended by 1s before and after the actual identified event.

Warning: for noise data to be coded with this command, the levels, duration and enhancements criteria must be fulfilled at the same time.

6.3.4. Example of threshold coding

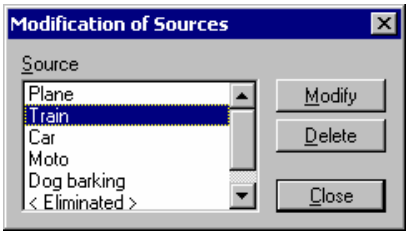
In this (theoretical) example, the threshold conditions have been defined

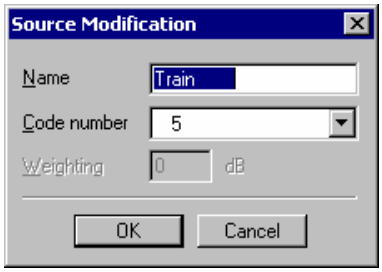
- Minimum threshold = 60 dB / Maximum threshold = 80 dB
- Minimum event duration = 1 second / Maximum event duration = 10 seconds.
- Enhancement duration before and after the event = 1 second



dBTRAIT32 will automatically code car no 1 and car no 2 but will not code the gunshot event (because this event duration is less than 1 second), nor the compressor event (because this event duration is more than 10 seconds). The enhancement duration before and after the coded event allows the program to code as well data that is obviously part of the event, but for which their values are below the minimum threshold.

6.3.5. Modifications of existing sources / Source menu





Use the command **Source / Modify** to change or remove the different types of existing sources in **dBTRAIT32**. The following dialog box is displayed on screen:

Select a source type in the list and click on **Modify** to edit the name and the priority code number of the source or click on **Delete** to completely remove this type of source from the datafile.

The **Weighting** field in dB corresponds to a correction factor that will be applied to all data coded with this type of noise source. It can be used, for example, to simulate how overall levels would be affected if the given noise event was reduced by N dB.

📖 *To activate this option, type in **SourceWeighting=1** in the field **[Settings]**, of the **DBTRAIT.INI** file**1***

6.3.6. Convert audio records into sources

By using the command **Aux / Audio / Convert to source**, it is possible to code the noise data time portion corresponding to an audio record duration.

The user select the audio records to convert (giving the start and end times for the coding operation) as well as an existing or a new source.

6.3.7. Convert comments into sources

By using the command **Aux / Comment / Convert to source**, it is possible to code the noise data time portion corresponding to an audio record duration.

The user select the audio records to convert (giving the start and end times for the coding operation) as well as an existing or a new source.

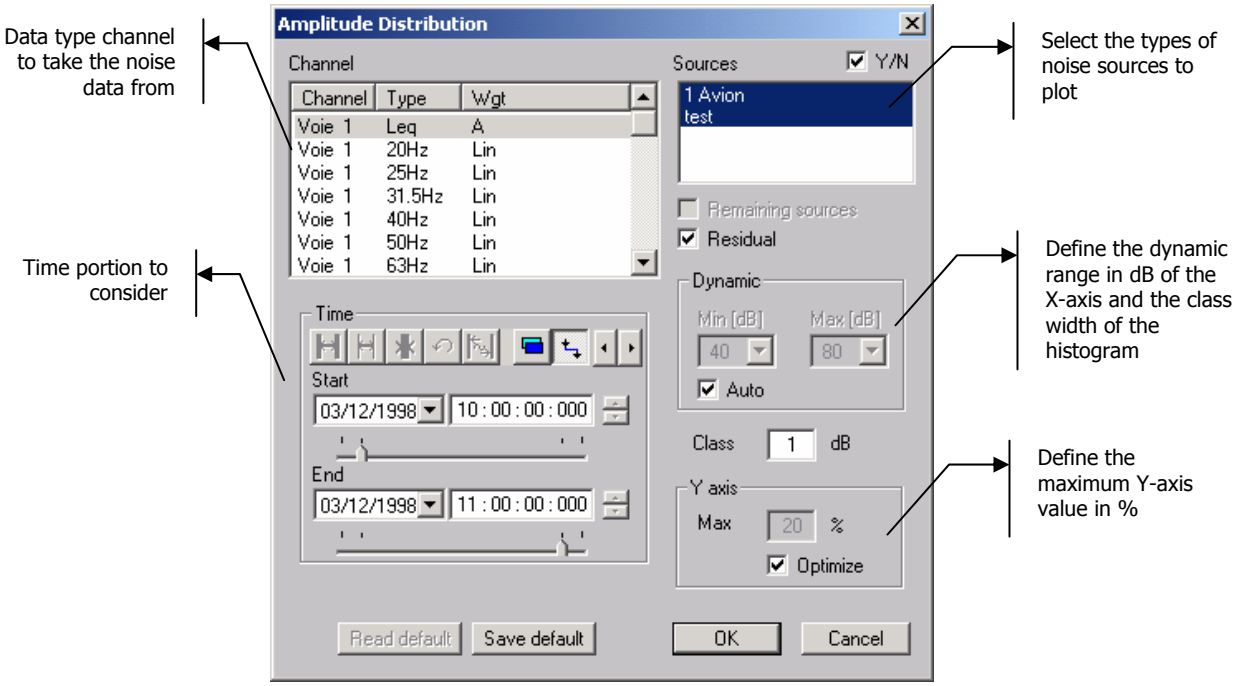
7. STATISTICAL DISTRIBUTION PLOTS

dBTRAIT32 allows the user to calculate level distribution and cumulated distribution plots.

7.1. Amplitude distribution plot

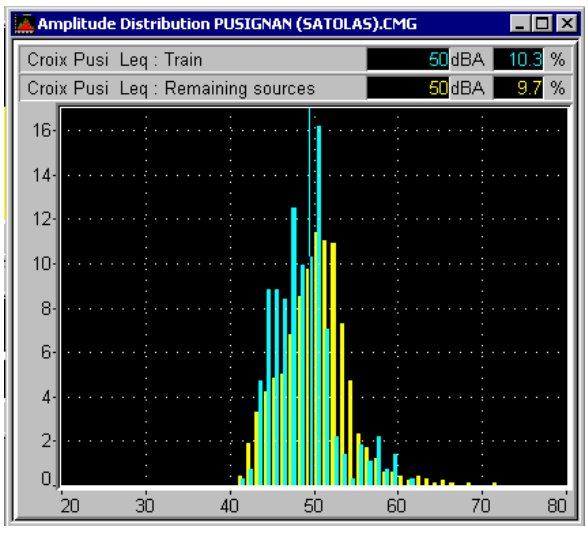
The amplitude distribution plot is an interesting tool to compare the level distribution of various noise sources in percent (including the comparison of level distribution of various noise sources). **dBTRAIT32** allows the amplitude distribution to be plotted with or without existing noise sources and the background noise on the same graph.

Use the command **Display / Amplitude distribution** to plot the amplitude distribution of noise levels. The following dialog box appears on screen:



In the field **X-axis**, it is possible to set automatically the dynamic range of the X-axis corresponding to the noise levels' distribution by ticking the **Auto** box. The width of each **class** is defined in dB. This value can vary from 0.1 dB to 20 dB in 0.1dB steps.

It is sometimes interesting to compare the level distributions of the background noise and one of the main noise sources. In the above example, we will compare the amplitude distributions of data coded as **Train** to the **Remaining Sources**. The resulting distribution plot is shown below:



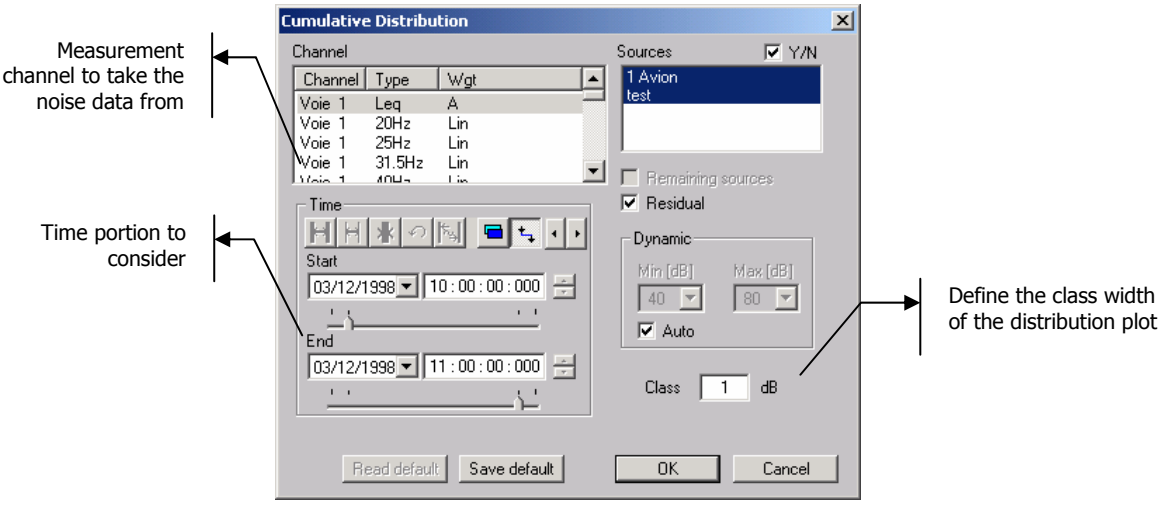
This plot represents the percentage of noise data contained in 1dB level classes for the data coded as aircraft and the rest of the data.

If the option **Background noise** was ticked, a third distribution would have been plotted, that would represent the amplitude distribution of the background noise (data not coded in the datafile).

7.2. Cumulative distribution

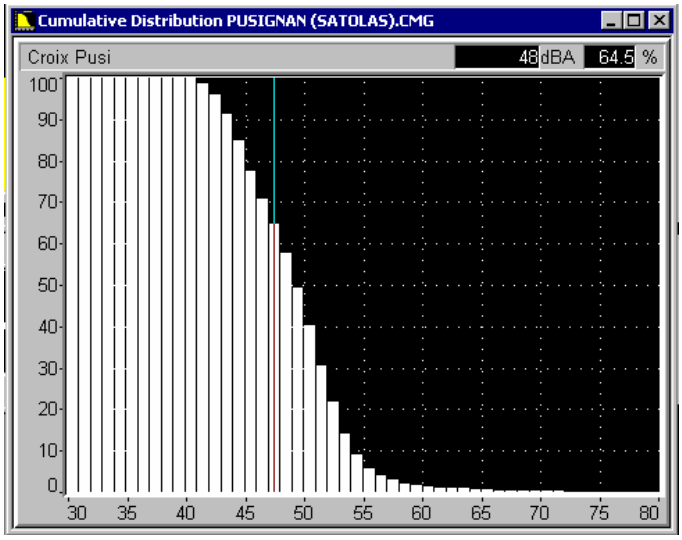
The cumulative distribution plot is used to display statistical indices (or percentiles) graphically. The percentiles may be calculated with a narrow integration step (0.1 dB), which allows particularly accurate study of the level distribution. The cumulative distribution is displayed regardless of the existing noise sources (overall result).

Use the command **Display / Cumulative distribution** to plot the statistical distribution. The following dialog box appears on screen:



The width of each **class** is defined in dB. This value can vary from 0.1 dB to 20 dB in 0.1dB steps.

Below is a typical cumulative distribution plot (statistical indices in classes of constant width as a function of level in dB):



In the above example, the statistical index **L64.5 = 48 dB(A).** It means that the noise levels in the datafile are equal to or greater than 48 dB(A) during 64.5% of the time.

Similarly, the statistical index Lmin, corresponding to the minimum short Leq value of the considered time portion is equal to 40 dB(A) in our example. It corresponds to the index L100, the noise level that is exceeded during 100% of the time.

The statistical index Lmax, corresponding to the maximum short Leq value of the considered time portion is equal to 72 dB(A) in our example. It corresponds to the index L0, the noise level that is exceeded during 0% of the time.

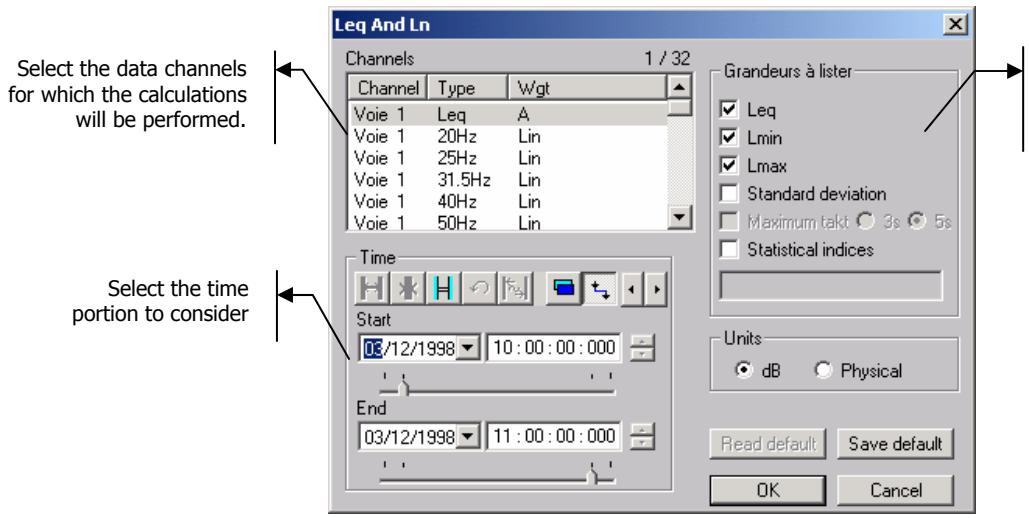
8. TABLE OF RESULTS

8.1. Listing of overall acoustical quantities

The following functions allow the user to calculate overall noise indicators without taking into account the different noise sources defined. Most of the indicators described here are defined in **chapter 17.**

8.1.1. Leq and Ln table (overall)

Use the command **Display / Leq and Ln** to calculate Leq values and statistical indices over a portion or the complete measurement file. The following dialog box appears on screen:



The software may calculate the following overall noise indicators:

- Leq
- Lmin
- Lmax
- Standard deviation
- Statistical indices (user-defined)
- Takt Maximal (German version)

The resulting table of results is displayed in a new window on validation by **OK**. An example is given below:

Overall Leq and Ln Table PUSIGNAN (SATOLAS).CMG

File	PUSIGNAN (SATOLAS).CMG												
Start	07/11/97 07:41:01												
End	07/11/97 11:00:23												
Channel	Type	dB	Leq	Lmin	Lmax	StdDev	L99.8	L95	L90	L50	L10	L8	L5
Croix Pusi	Leq	A	52,0	39,5	73,8	4,3	40,0	42,1	43,1	48,8	53,7	54,1	55,2
Croix Pusi	Peak	Lin		69,3	98,4	3,4	69,9	72,2	72,9	76,6	81,2	81,7	82,7
Croix Pusi	1/3 Oct 20Hz	Lin	55,2	42,7	73,7	3,7	44,5	47,7	48,7	52,5	58,1	58,7	60,1

The table of results features a toolbar with icons that allows the user to modify the calculations' parameters for example. The icons of listing window toolbar allows the user to perform the following operations:

Change the listing parameters

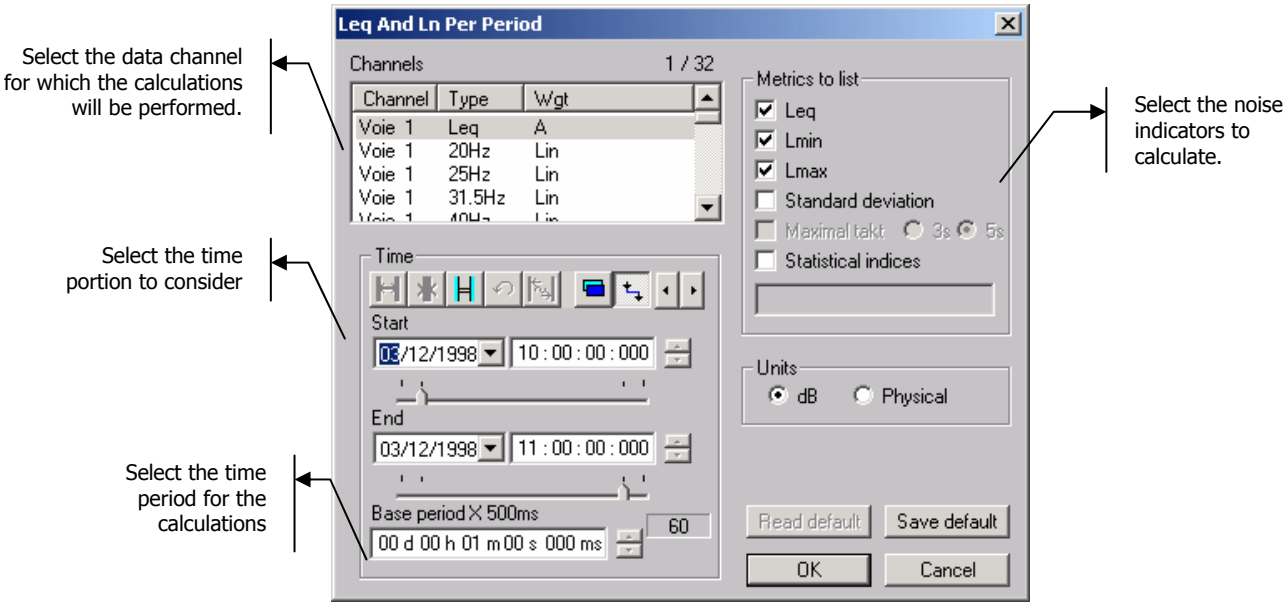
Display as a graphical plot the results in the frequency bands (spectrum data)

Activate (or not) the automatic window resizing operation when the contents have changed.

*For more information on how to display noise indicators graphically, see **paragraph 8.3**. These calculations are made without taking into account existing noise sources. For more information on the calculations of noise indicators with sources' information, see **paragraph 8.2.***

8.1.2. Leq and Ln (per period)

Use the command **Display / Leq and Ln per period** to calculate Leq values and statistical indices over a portion or the complete measurement file for user-defined time periods. The following dialog box appears on screen:



The software may calculate the following indicators for each period:

- Leq
- Lmin
- Lmax
- Standard deviation
- Statistical indices (user-defined)
- Takt Maximal (German version)

The resulting table of results is displayed in a new window on validation by **OK**. An example is given below:

Leq by periods PUSIGNAN (SATOLAS).CMG

File	PUSIGNAN (SATOLAS).CMG										
Location	Croix Pusi										
Weighting	A										
Data type	Leq										
Start	07/11/97 07:30:00										
End	07/11/97 11:30:00										
Period	30m										
Period start	Leq	Lmin	Lmax	StdDev	L99.8	L95	L90	L50	L10	L8	L5
07/11/97 07:30:00	53,1	46,4	65,7	2,7	46,6	48,1	48,7	51,4	55,2	55,8	57,4
07/11/97 08:00:00	51,3	45,0	58,9	2,4	45,1	46,6	47,5	50,4	53,8	54,2	54,7
07/11/97 08:30:00	51,8	43,3	68,4	2,8	43,9	45,7	46,9	50,6	53,4	53,8	54,5
07/11/97 09:00:00	55,9	44,7	73,8	4,0	45,1	46,8	47,5	51,4	55,7	56,6	59,5
07/11/97 09:30:00	46,3	39,7	58,5	2,8	40,0	41,4	41,9	44,5	48,8	49,3	50,6
07/11/97 10:00:00	48,1	40,9	61,4	3,1	41,2	42,5	43,0	45,9	50,4	51,0	52,4
07/11/97 10:30:00	51,7	39,5	71,1	4,9	39,6	40,8	41,4	44,8	53,1	54,4	56,5
07/11/97 11:00:00	50,0	43,9	56,5	4,0	43,8	43,8	44,2	45,4	54,7	55,3	55,3
Overall	52,0	39,5	73,8	4,3	40,0	42,1	43,1	48,8	53,7	54,1	55,2

The table of results features a toolbar with icons that allows the user to modify the calculations' parameters for example. The icons of listing window toolbar allows the user to perform the following operations:

Change the listing parameters

Activate (or not) automatic window resizing operation when the contents have changed.

8.1.3. Leq and statistical indices by statutory periods

The statutory period's options are used to make calculations of various acoustic parameters within fixed daily or weekly periods. These calculations are intended for use with long term CMG datafiles.

Let consider a weeklong measurement file. They are enough data in it to calculate the global day noise level (say from 8 am until 8 pm) over the whole week, or only during working days, or day by day. To do so, it is sufficient to limit the calculations to the appropriate time slices of the measurement slices.

Such an operation can be done manually, using the option **Leq and Ln** of the **Display** menu for each required time period and then calculating the overall level. The **Statutory periods** option allows the user to perform automatically these fastidious calculations.

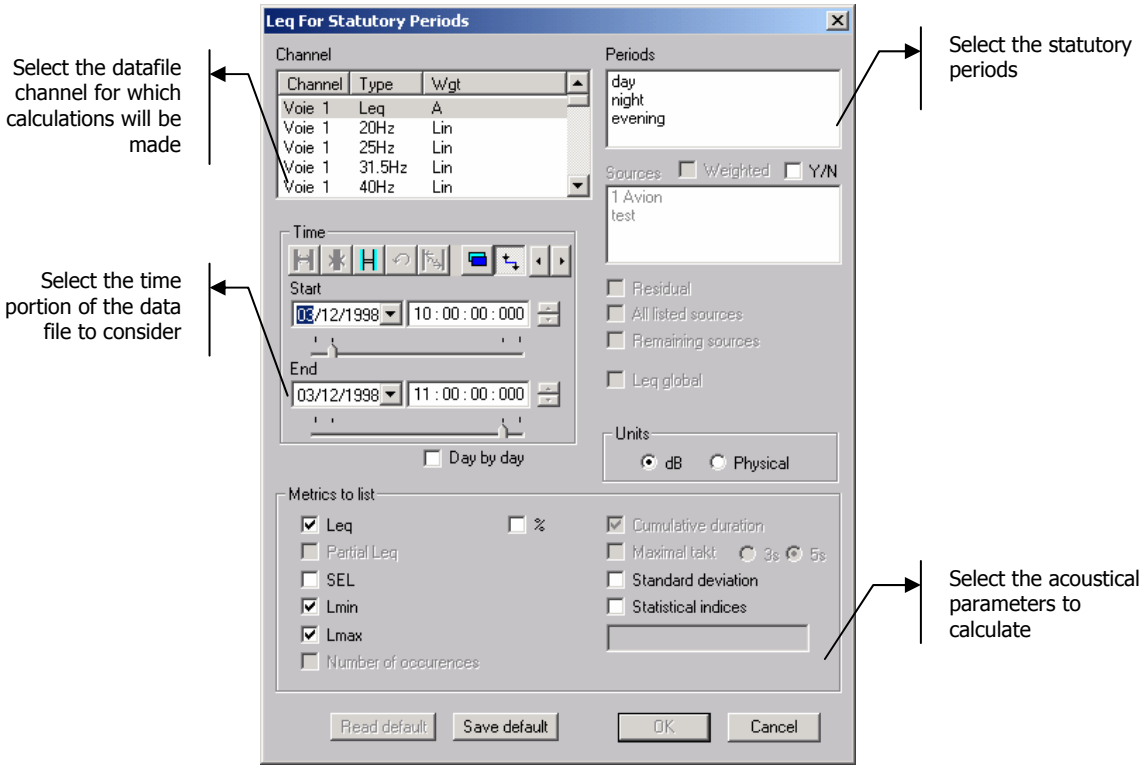
The term "statutory periods" does not only apply to standardised time periods but also to user defined time periods. One can define for example the period between 18h and 19h corresponding to the time people come back from the office. Even if such a period does not apply to any regulation, **dBTRAIT32** will accurately calculate noise levels.

Two operations are necessary to obtain noise levels during specific periods:

- Definition (& edition) of the time periods.
- Definition of the calculation parameters and results' display.

To define statutory periods, use the command **Preferences / Statutory periods**. This issue is dealt with in **chapter 10.**

Use the command **Display / Statutory periods** for calculations of the acoustical indicators corresponding to the statutory periods defined by the user. The following dialog box appears on screen:



The option **Daily** means that the acoustical parameters will be calculated day by day. In other words, one can obtain the daily results for measurement datafiles that last over several days.

This option is greyed if calculations apply to weekly periods. It has another limitation: **It can only be applied when a single daily 24-hour period is selected**. The option will therefore also be greyed if two 24-hour cycles are selected in the above dialog box. This limitation is due to the complexity of such listing.

The window shown below shows a sample statutory periods listing:

Statutory periods B0311000.CMG

File	B0311000.CMG									
Location	office									
Weighting	A									
Data type	Leq									
Start	03/11/94 07:00:00									
End	12/11/94 21:00:00									
Period	day									
Time slices	08:00 - 20:00									
Date	Leq	Lmin	Lmax	L99.8	L95	L90	L50	L10	L8	L5
03/11/1994	62,8	56,8	70,0	57,5	60,1	60,9	62,6	64,2	64,4	64,7
04/11/1994	60,0	48,2	70,3	48,4	50,8	57,2	59,8	61,7	61,9	62,3
05/11/1994	55,9	46,6	63,5	46,6	48,1	48,6	56,2	58,7	58,9	59,2
06/11/1994	60,2	54,8	67,2	55,4	57,0	57,6	59,9	61,8	61,9	62,3
07/11/1994	67,7	62,5	71,9	63,0	65,0	65,9	67,4	68,9	69,0	69,3
08/11/1994	63,3	53,7	70,8	54,6	57,3	58,0	60,9	66,9	67,1	67,4
09/11/1994	58,6	55,6	65,1	55,6	56,3	56,9	58,1	59,9	60,1	60,4
10/11/1994	55,7	52,2	67,8	52,5	52,8	52,9	53,9	58,0	58,2	58,6
11/11/1994	75,5	52,2	94,4	52,5	53,8	54,2	55,8	57,5	57,7	58,1
12/11/1994	56,2	48,6	62,2	49,0	51,4	52,2	55,8	58,3	58,5	58,8

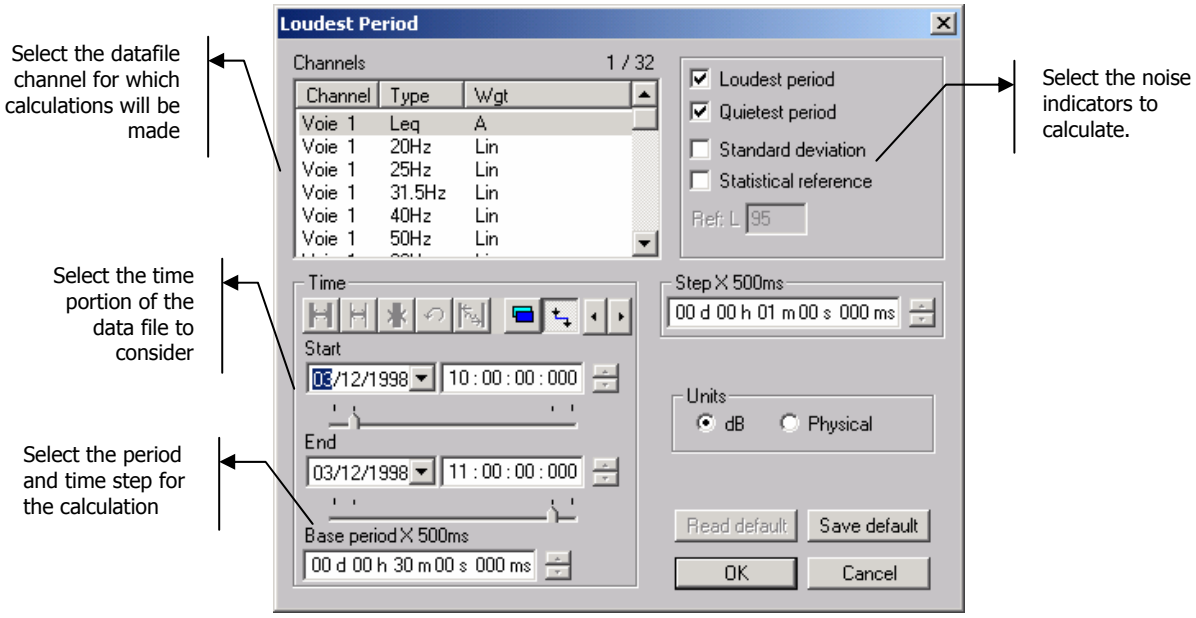
The table of results features a toolbar with icons that allows the user to modify the calculations' parameters for example. The icons of listing window toolbar allows the user to perform the following operations:

Change the listing parameters

Activate (or not) automatic window resizing operation when the contents have changed.

8.1.4. Loudest (and quietest) periods

Use the command **Display / Loudest period** to calculate the loudest and/or quietest time period of the measurement datafile. The following dialog box appears on screen:

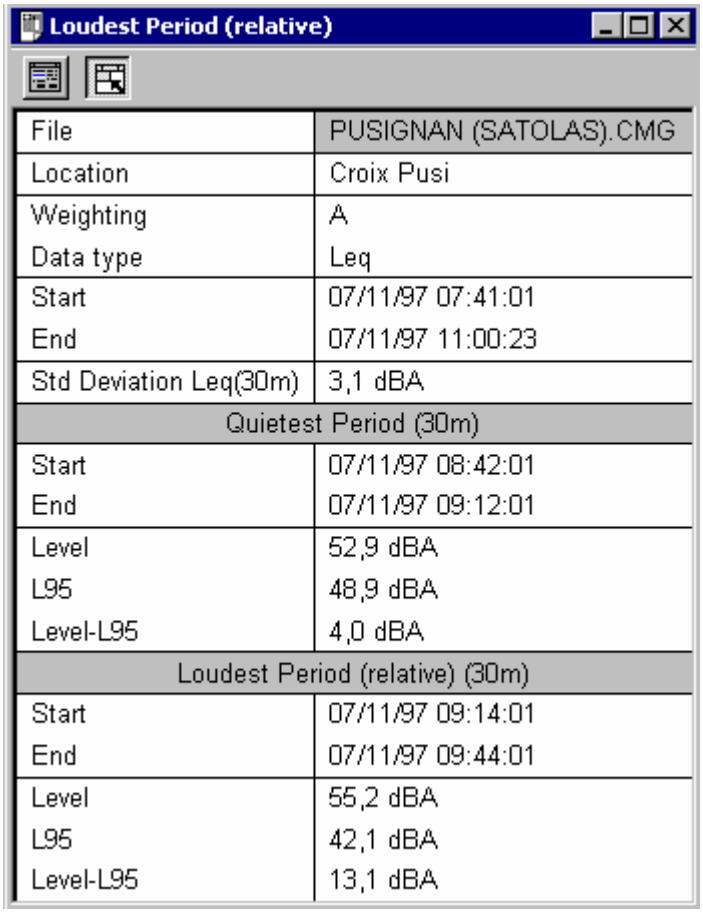


In the fields **Period** and **Step**, define respectively the cumulated duration for the calculation of the loudest and/or quietest periods and the time step for intermediate calculations. In our example, with a step of 1 minute and a period of 30 minutes, the software will calculate the Leq minute by minute, and, by comparison of these intermediate calculations, will calculate the loudest and quietest 30 minutes of the datafile.

Select **Standard deviation** to display the deviation between minimum and maximum values of the noise levels over the cumulated duration of the period.

Select **Compare to a percentile** and type in the **Ln** index to compare the equivalent sound pressure levels and the defined percentile over the cumulated duration of the period.

On validation of these parameters, **dBTRAIT32** calculates the loudest and/or the quietest periods for the selected time portion of the datafile. The resulting table is displayed in another window (such as shown below)



Loudest Period (relative)

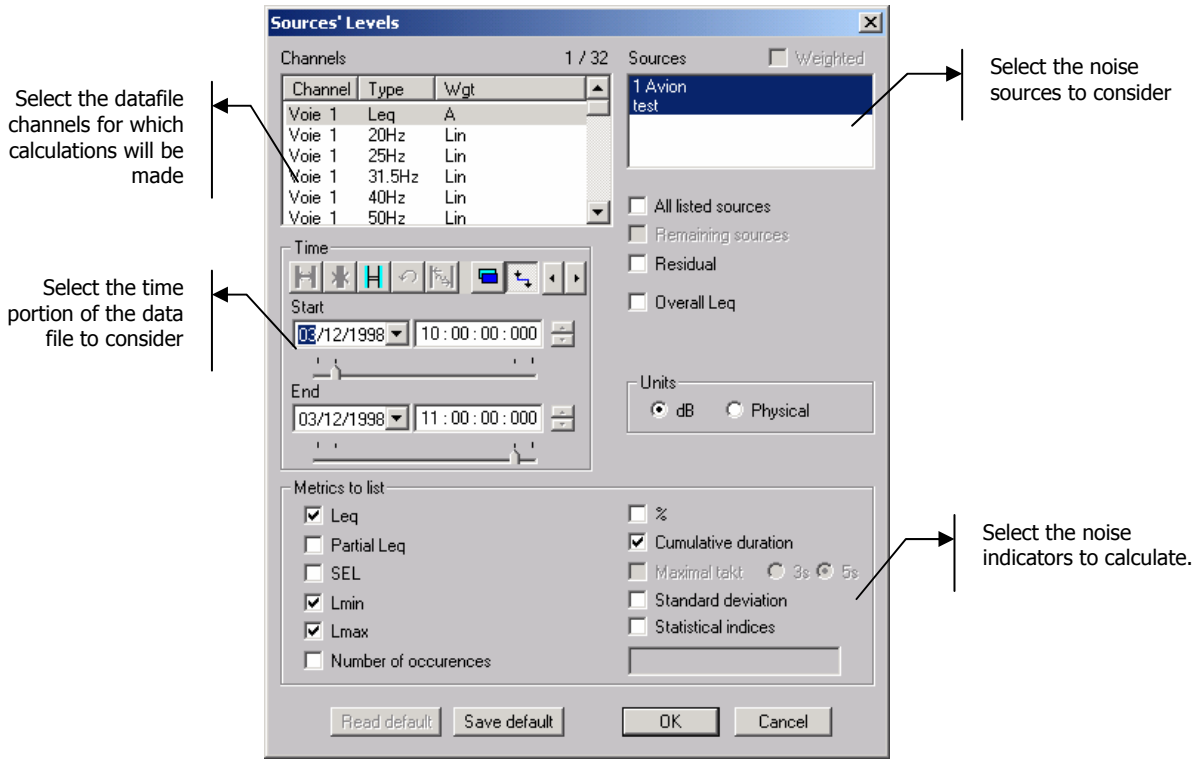
File	PUSIGNAN (SATOLAS).CMG
Location	Croix Pusi
Weighting	A
Data type	Leq
Start	07/11/97 07:41:01
End	07/11/97 11:00:23
Std Deviation Leq(30m)	3,1 dBA
Quietest Period (30m)	
Start	07/11/97 08:42:01
End	07/11/97 09:12:01
Level	52,9 dBA
L95	48,9 dBA
Level-L95	4,0 dBA
Loudest Period (relative) (30m)	
Start	07/11/97 09:14:01
End	07/11/97 09:44:01
Level	55,2 dBA
L95	42,1 dBA
Level-L95	13,1 dBA

8.2. Listing of noise sources' acoustical quantities

The following functions allow the user to calculate noise indicators taking into account noise sources.

8.2.1. Levels of defined noise sources (overall)

Use the command **Display / Sources** to calculate noise indicators of the defined noise sources over a portion or the complete measurement datafile. The following dialog box appears on screen:



The software may calculate the following indicators:

- Particular Leq
- Partial Leq
- SEL
- Lmin
- Lmax
- Number of appearances of the source
- % of the file containing the code
- Cumulated duration of the source
- Takt Maximal (German version)

These indicators are calculated for each noise sources selected in the list, as well as for the **remaining sources** (the sources that are not selected considered as a single source). If the option **Listed sources together** is ticked, the calculations will also be performed for all the sources selected in the list. If the option **Background noise** is ticked, the calculations will be performed for the rest of data. The option **Overall Leq** allows the user to calculate the indicators for coded and uncoded data, for each measurement channel.

The option **Weighted** can be used to calculate the indicators with weighted sources. A source weighting (or attenuation by a user-defined factor) can be defined by the command **Source / Modify**. See **paragraph 6.3.5.** This option is greyed when no attenuation coefficient is defined.

The resulting table of results is displayed in a new window on validation by **OK**.

Source Levels PUSIGNAN (SATOLAS).CMG

File	PUSIGNAN (SATOLAS).CMG									
Start	07/11/97 07:41:01									
End	07/11/97 11:00:23									
Source	Train					Remaining sources				
Location	Leq source dB	Leq (partial) %	Lmin dB	Lmax dB	Duration cumulated h:min:s	Leq source dB	Leq (partial) %	Lmin dB	Lmax dB	Duration cumulated h:min:s
Croix Pusi [Leq]	50,7	1,7	41,9	61,4	00:04:31	53,8	75,7	40,8	73,8	01:40:10
Croix Pusi [1/3 Oct 1kHz]	42,8	2,2	31,6	52,9	00:04:31	44,4	70,7	27,2	64,9	01:40:10

The table of results features a toolbar with icons that allows the user to modify the calculations' parameters for example. The icons of listing window toolbar allows the user to perform the following operations:

Change the listing parameters

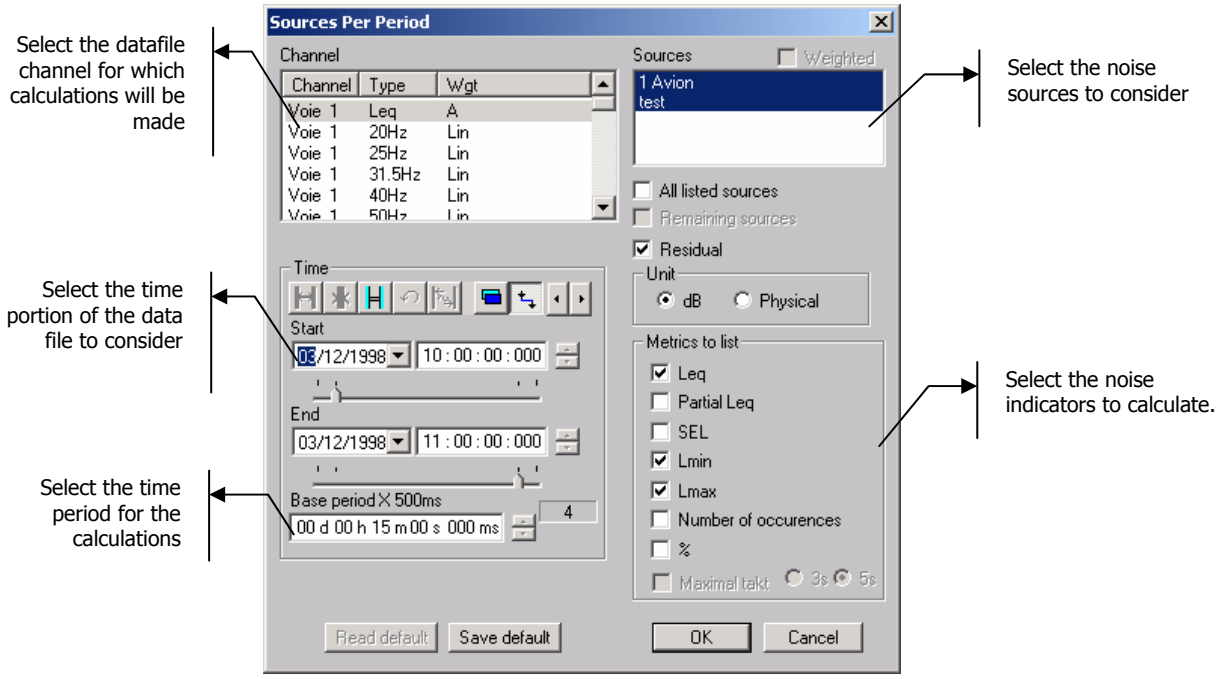
Display as a graphical plot the results in the frequency bands (spectrum data)

Activate (or not) the automatic window resizing operation when the contents have changed.

*Data display of listed spectra is dealt with in **paragraph 8.3**.*

8.2.2. Levels of defined noise sources (per periods)

Use the command **Display / Sources per periods** to calculate noise indicators of the defined noise sources over a portion or the complete measurement datafile for user-defined time periods. The following dialog box appears on screen:



The software may calculate the following indicators, for each period:

- Particular Leq
- Partial Leq
- SEL
- Lmin
- Lmax
- Number of appearances of the source
- % of the file containing the code
- Cumulated duration of the source
- Takt Maximal (German version)

These indicators are calculated for each noise sources selected in the list, as well as for the **remaining sources** (the sources that are not selected considered as a single source). If the option **Listed sources together** is ticked, the calculations will also be performed for all the sources selected in the list. If the option **Background noise** is ticked, the calculations will be performed for the rest of data.

The resulting table of results is displayed in a new window on validation by **OK**.

Source Table PUSIGNAN (SATOLAS).CMG

File	PUSIGNAN (SATOLAS).CMG														
Location	Croix Pusi														
Weighting	A														
Data type	Leq														
Start	07/11/97 07:30:00														
End	07/11/97 11:00:00														
Period	15m														
Source	Car					Remaining sources					Background				
Period start	Leq	%	Lmin	Lmax	Count	Leq	%	Lmin	Lmax	Count	Leq	%	Lmin	Lmax	Count
07/11/97 07:30:00	51,8	18,4	49,1	55,7	2	49,2	0,9	47,6	51,2	2	50,5	8,6	46,4	55,3	3
07/11/97 07:45:00	52,2	3,7	47,5	55,6	4	53,9	54,7	47,0	65,7	5	53,0	28,8	47,1	63,0	8
07/11/97 08:00:00	53,1	10,6	47,7	57,7	8	52,2	29,5	46,4	57,0	6	51,2	23,3	45,0	56,5	6
07/11/97 08:15:00	51,0	16,3	45,5	57,6	11	50,0	16,3	45,2	55,2	11	50,9	20,5	45,0	58,9	14
07/11/97 08:30:00	51,0	35,6	43,5	57,1	11	49,2	14,6	44,2	55,8	11	48,8	8,2	43,3	54,9	10
07/11/97 08:45:00	52,2	3,5	49,7	55,4	2	53,5	69,3	48,0	68,4	5	51,3	8,2	48,0	55,7	5
07/11/97 09:00:00	53,8	1,7	50,8	56,5	7	59,2	169,8	49,7	73,8	7	51,8	24,6	46,9	57,6	9
07/11/97 09:15:00	60,3	48,6	45,5	71,4	4	52,7	44,5	45,2	64,3	11	49,6	8,7	44,7	58,0	12
07/11/97 09:30:00	49,2	21,4	42,3	58,5	8	48,6	7,9	41,5	58,1	5	45,6	8,0	40,7	54,5	7
07/11/97 09:45:00	46,2	19,9	41,6	51,7	6	46,2	5,0	41,7	51,7	10	44,0	5,1	39,7	50,1	10
07/11/97 10:00:00	50,9	17,6	41,8	57,9	7	47,8	5,9	43,3	53,4	2	46,5	11,5	41,3	55,1	9
07/11/97 10:15:00	47,7	6,8	43,5	53,0	4	52,4	15,3	41,6	61,4	7	46,4	11,6	40,9	54,5	4
07/11/97 10:30:00	48,4	25,3	40,8	56,4	16	47,0	3,2	41,2	53,0	4	44,8	8,0	39,5	53,1	19
07/11/97 10:45:00	60,2	69,2	42,5	71,1	9	53,3	21,5	42,5	60,8	3	46,3	9,3	39,9	55,6	10
Overall	54,6	21,2	40,8	71,4	99	53,4	0,0	41,2	73,8	89	48,8	0,0	39,5	63,0	126

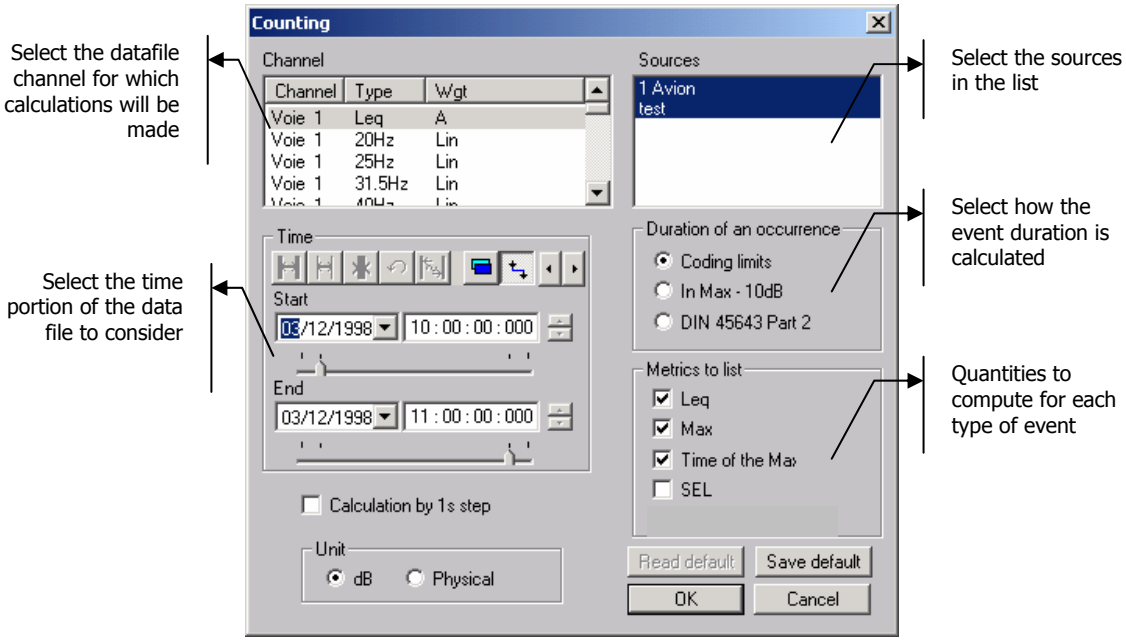
The table of results features a toolbar with icons that allows the user to modify the calculations' parameters for example. The icons of listing window toolbar allows the user to perform the following information:

Change the listing parameters

Activate (or not) the automatic window resizing operation when the contents have changed.

8.2.3. Counting sources

Use the command **Display / Count** to count the number of times sources appears in the measurement datafile. The following dialog box appears on screen:



The duration of any particular event can be considered in two ways : either the duration of the coded event (coding limits) or the duration corresponding to the Max level - 10dB. This max level is either the maximum level it self or the Leq(1s) corresponding value (If possible).

On validation of this dialog box, the following table of results is displayed on screen in another window:

Complete Count PUSIGNAN (SATOLAS).CMG

File	PUSIGNAN (SATOLAS).CMG				
Source	Train				
Location	Croix Pusi				
Weighting	A				
Data type	Leq				
Start	07/11/97 07:41:01				
End	07/11/97 11:00:23				
Appearance	Duration	Leq	Lmax	Time Lmax	SEL
07/11/97 08:19:46	0:00:27	48,8	51,2	07/11/97 08:19:54	63,1
07/11/97 08:20:19	0:00:06	51,4	52,0	07/11/97 08:20:23	59,2
07/11/97 08:38:44	0:00:30	49,2	50,9	07/11/97 08:38:48	64,0
07/11/97 08:41:28	0:00:07	50,4	51,5	07/11/97 08:41:29	58,9
07/11/97 08:41:36	0:00:01	48,3	48,3	07/11/97 08:41:36	48,3
07/11/97 08:44:01	0:00:37	50,8	52,8	07/11/97 08:44:05	66,5
07/11/97 09:50:59	0:00:21	45,3	46,8	07/11/97 09:51:19	58,5
07/11/97 09:58:29	0:00:21	43,8	44,9	07/11/97 09:58:32	57,0
07/11/97 10:11:49	0:01:01	47,1	51,2	07/11/97 10:12:26	65,0
07/11/97 10:19:54	0:00:41	55,1	59,2	07/11/97 10:19:54	71,2
07/11/97 10:29:48	0:00:05	59,2	61,4	07/11/97 10:29:50	64,0
07/11/97 10:30:13	0:00:14	48,3	50,2	07/11/97 10:30:17	59,8
Total: 12	0:04:31	50,9	61,4		75,2

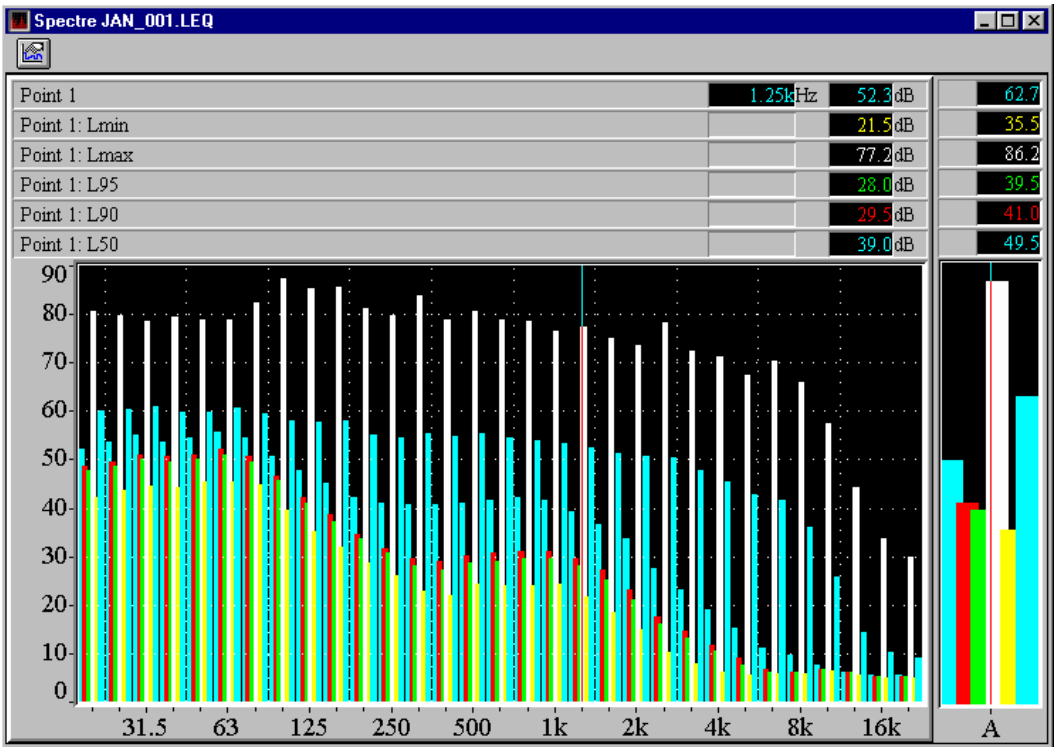
The counting operation allows the user to obtain the following results for each source's appearance:

- Time and date of the appearance
- Duration of each source appearance
- Particular Leq, Lmax, time of appearance of Lmax and SEL for each source appearance
- Total number of appearances for each type of source
- Total duration for each type of source
- Overall Leq, Lmax and SEL for each type of source

8.3. Display listed spectra as graphics

When calculating overall acoustical quantities (see **paragraph 8.1.1**) and/or levels for noise sources (see **paragraph 8.2.1**) the resulting indicators may be displayed in a graphical manner **if the measurement channels selected for the calculations correspond 3to the frequency bands of a spectrum**.

This type of graphic may be accessed by the icon of the table of results or by the command **Listing / Plot spectra.**



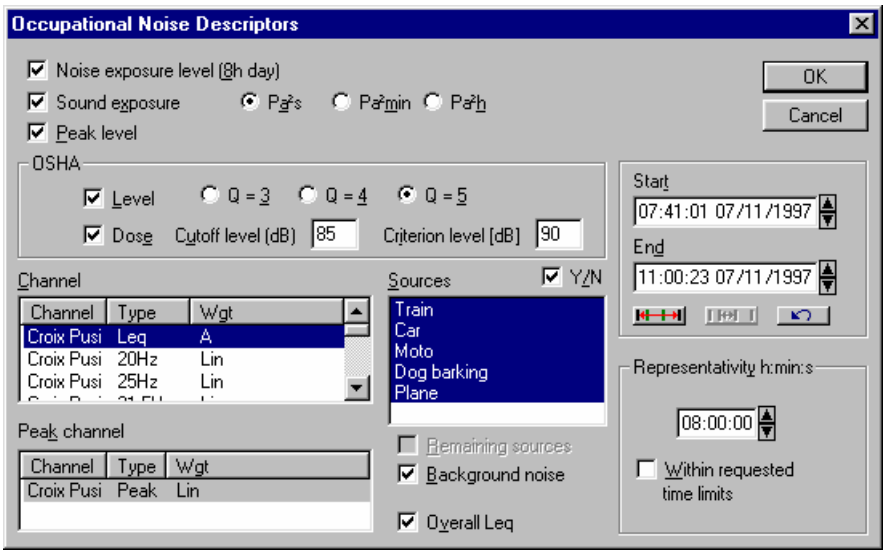
A maximum of 6 curves can be plotted simultaneously on the same graphic.

9. OCCUPATIONAL NOISE (OPTION)

Use the command **Display / Occupational noise** to calculate acoustical indicators related to various regulations of noise at work. The following indicators may be calculated globally or for each selected noise sources:

- Noise Exposure Level (8 h Day)
- Sound Exposure (in Pa²s, Pa²min or Pa²h)
- Peak level
- OSHA level
- OSHA dose

The occupational noise dialogue box will be displayed in order to define the parameters of the calculation. The listing of the occupational noise indicators is therefore displayed:



- **Channel**

Select one measurement channel, between those available, to calculate for.

- **Peak channel**

Select here the peak channel to be scanned for Peak related indicators. The list of existing peak channels for the current file is displayed. Its identifier identifies each channel corresponding to a certain type of data stored during measurement. When only one peak channel is present, this field is disabled and the peak channel is displayed and selected by default.

- **Hour and time (start / end)**

To calculate on only a portion of the file, uncheck the **Complete file** option and select the period. When ticked, the **Complete file** option ignores the settings in **Start** and **End** and calculates the parameters on the complete file.

- **Representativity (hh :mm :ss)**

Define here the duration to take into account as the representative duration for the computation. Let us consider a measurement between 10:00am and 10:15am, fifteen minutes only. The factory operation measured lasts 4 hours per day, same level. The representativity of the measurement done is then 4 hours.

Select 8 hours if you have measured noise levels constant over the whole working day.

If you have measured a full factory operation (i.e. the duration of the measurement corresponds to the duration of the factory operation), select the **Within Requested Time Limits** option to set the representativity to the duration of the selected time section.

- **Sources / Remaining sources / Background noise**

Select in a list the noise sources to consider (or not) for the calculations. Before proceeding with the calculation, it may be required to code events as specific noise sources. See **chapter 6** for coding noise events.

The option **Remaining sources** allows the user to calculate the specified noise indicators for all sources that have not been selected. These sources, except the background noise, are put together as a single source named "remaining sources". This option may be useful to estimate the contribution of a source compared to all the other sources, for instance. The selection will be recalled as default value next time such a command is used.

The option **Background noise** allows the user to calculate the specified indicators for the source named "background". This source represents all the noise data in the file that have not been coded as a specific noise source. The selection will be recalled as default value next time such a command is used.

The option **Overall Leq** allows the user to calculate the equivalent sound pressure level for each selected source over the considered time portion. This value will be display at the bottom of the listing window.

- **Noise exposure level (8h day)**

Click this option in order to include the computation of the Noise Exposure Level called LEX,d. It is calculated as follows:

$$L_{EX,d} = 10 * Log\left[\frac{1}{T_0}\int_0^T \left(\frac{P_A(t)}{P_0}\right)^2 dt\right]$$

Where:

T_0 is the reference duration T0 = 28800 s = 8 hours
T_d is the representative duration (defined as "representativity" in the dialog box)
$P_A(t)$ is the A weighted sound pressure level
P_0 is the reference sound pressure level $P_0 = 2^{e-5}$ Pa

- **Sound exposure**

Click this option in order to include the computation of the Sound Exposure called $E_{A,T}$. Once enabled, this option allows to select the units to express the Sound Exposure (Pa2s, Pa2min or Pa2h). It is calculated as follows:

$$E_{A,T} = \int_{t_1}^{t_2} p_a^2(t)\,dt$$

Where:

$P_A(t)$ is the A weighted sound pressure level

- **Peak level**

Click this option in order to include the computation of the Peak Level, called Lpc. This option is only available if a Peak Channel exists. It is calculated as follows:

$$L_{pc} = 10\,Log\left(\frac{P_c}{P_0}\right)^2$$

Where:

PC is the maximum instantaneous sound pressure level over the considered time interval
P_0 is the reference sound pressure level $P_0 = 2^{e-5}$ Pa

- **OSHA (level)**

Click this option in order to include the computation of the OSHA Level, called Lav(Q). Once enabled, this option allows to select the OSHA Factor Q (3, 4 or 5) and the cut-off Level in dB. It is calculated as follows:

$$L_{av}(Q) = q * \mathrm{Log}\left[\frac{1}{T}\int_0^T 10^{L_{AS}/q}dt\right]$$

Where:

L_{AS} is the A weighted sound pressure level, usually exponentially averaged with the SLOW time constant
Q is the exchange rate selected in the dialog box
q = Q / Log(2)
T is the considered time period

The **cut-off level** is the limit below, which the level are not taken into account for the OSHA calculation.

- **OSHA (Dose)**

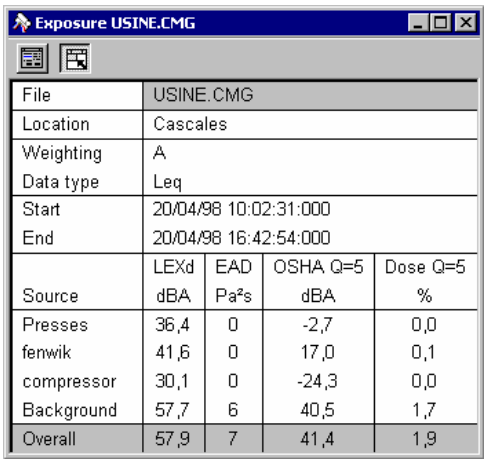
Click this option in order to include the computation of the OSHA Dose, called D. Once enabled, this option allows to select the Criterion Level. It is calculated as follows:

$$D = \frac{100}{T_c}\int_0^T 10^{(L_{AS}-L_C)/q}dt$$

Where:

L_{AS} is the A weighted sound pressure level, usually exponentially averaged with the SLOW time constant
Q is the exchange rate selected in the dialog box
q = Q / Log(2)
Lc is the criterion level selected in the dialog box
Tc = 8 hours
T is the considered time period

The **cut-off level** is the limit below, which the level are not taken into account for the OSHA calculation. Define also the criterion level in dB. This level establishes the crossing point between the curve of slope 5 (Q exchange rate) and the energy curve.
If, for example, we have a constant level of 95 dBA, measurement with Q=5 will give a dose of 200% for a criterion level of 90dB, and 100% for a criterion level of 95dB, and 50% for 100 dB. The OSHA dose is expressed in time percentile of the acceptable dose.



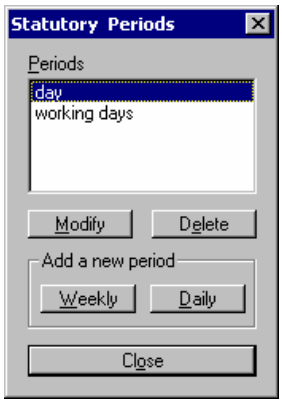
File	USINE.CMG			
Location	Cascales			
Weighting	A			
Data type	Leq			
Start	20/04/98 10:02:31:000			
End	20/04/98 16:42:54:000			
Source	LEXd dBA	EAD Pa²s	OSHA Q=5 dBA	Dose Q=5 %
Presses	36,4	0	-2,7	0,0
fenwik	41,6	0	17,0	0,1
compressor	30,1	0	-24,3	0,0
Background	57,7	6	40,5	1,7
Overall	57,9	7	41,4	1,9

Here is an example of results of occupational noise calculation. . It may be done with or without the existing sources over a section of the considered file. The term "source" may be in this case applied to a particular industrial operation. The operator can calculate the contribution of different operations on the global daily noise.

📖 *Copy this result listing (command Edit / Copy) as values or graphics for further exploitation and result presentation in spreadsheet or word processors*

10. DEFINITIONS OF STATUTORY PERIODS

Use the command **Preferences / statutory periods** to define time periods according to which noise levels may be calculated (see **paragraph 8.1.3**). The dialog box shown below appears on screen:



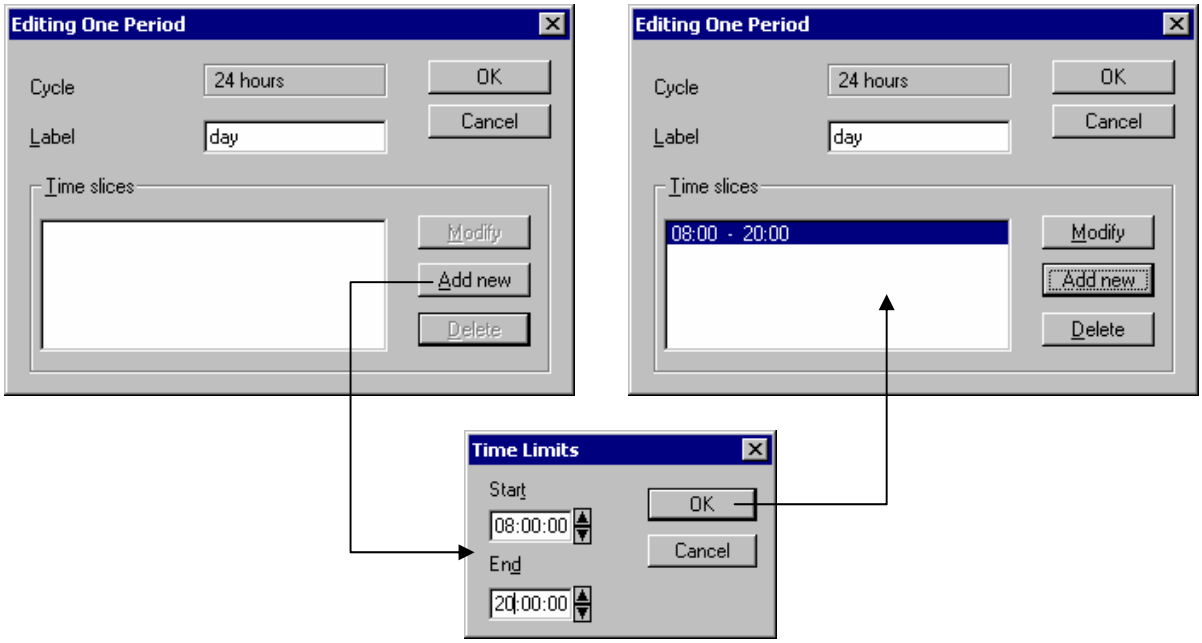
The choice is given between definition of weekly and daily periods.

A **Daily** period means that it will be repeated identically whatever the day of the week. (For example, no difference will be made between results in the time slice 8h-20h of a weekday and a bank holiday day).

With a **weekly** period, the software can differentiate between weekdays' periods (for example 8h – 20h) and weekend periods (for example from Friday 18h to Monday 6h).

10.1.1.Daily (24-hour) cycle

This section describes the procedure to programme a 24-hour cycle.

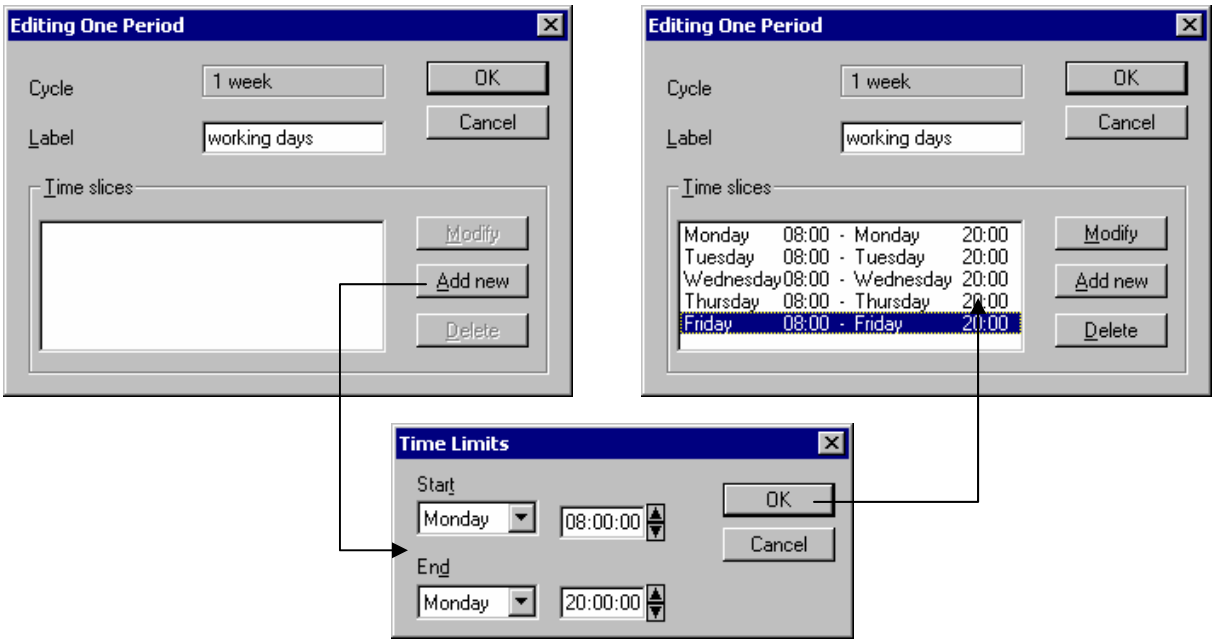


Give a name to the period (for example, day). To accept the time slot, click on **Add**. Use the up/down arrows to specify the exact start and end time. Validate with "OK". The preceding window is re-displayed with the current settings.

Other time slots may be added, while existing entries may be modified or deleted, using respectively the buttons **Modify** and **Remove**.

10.1.2.Weekly (7-day) cycle

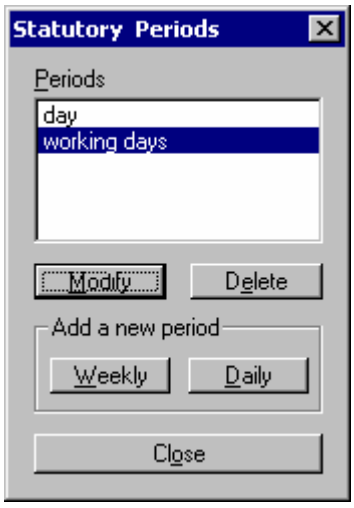
In order to define a 7-day cycle, proceed as follows:



For example, a period named "working days" has a 7day cycle, with time slots set between 8 a.m. and 8 p.m.; from Monday to Friday inclusive.

Add the first time slot: Monday, between 8 hrs and 20 hrs. Access the list of days and increment the time using the arrows adjacent to the boxes.

Validate then repeat this operation for the other days until Friday. The Period Edition window contains 5-hour slots corresponding to the 5 days of the week.



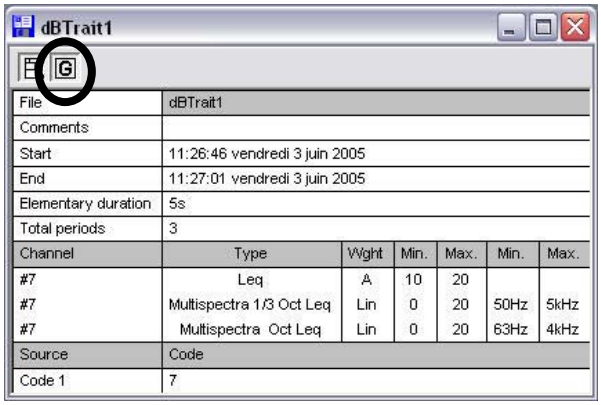
The list of periods is also adjusted.

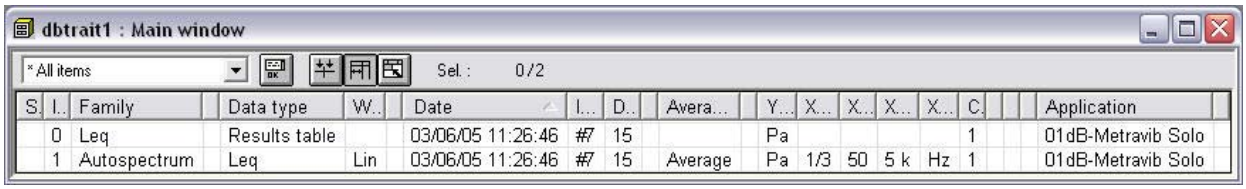
Close the dialogue box in order to close the operation. The periods are saved by default and are resumed at the next use of the programme.

Note that an overlap of two time slots is not possible; and that from a calculation point of view, two time slots that are concurrent will be considered as one slot.

11. GLOBAL ITEMS VIEW

As of version 4.7, global items (overall values, overall spectra) are managed in a separate view that can be accessed from the "**Window – Global items view**" menu.





This view allow for a simpler management of global items, especially tables of overall values transferred from the SOLO sound level meter.

Also, some operations can be performed on spectra from this display.

11.1. General functions

11.1.1.Opérations sur les items d'une fenêtre d'items globaux

This windows lists all global items transferred from SOLO or added from the spectrum history plot. Double-click on any item to open it.

This view is displayed from the Window / Global items view menu (accessible if file *dBtrait_Global.cmg* exists and is not empty).

Adding an global item from the program automatically opens this window and creates the measurement session file if it does not exist yet.

Use these buttons to, respectively:

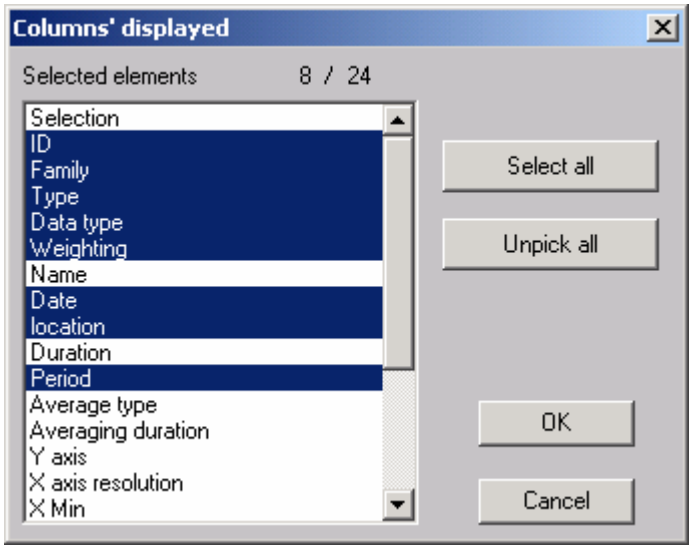
- Display spectrum or table for selected item (several items can be selected in order to superimpose spectra)
- List values for the selected spectrum(a)
- Remove one or more spectra from the view
- Change some parameters relative to selected items
- Create a new spectrum
- Add selected spectra
- Subtract selected spectra
- Average selected spectra
- Correct a spectrum
- Convert a spectrum into an octave spectrum
- Display NR/NC curves (option)

📖 Items of the list can be sorted by clicking on column headers.
Use buttons in the main window to:

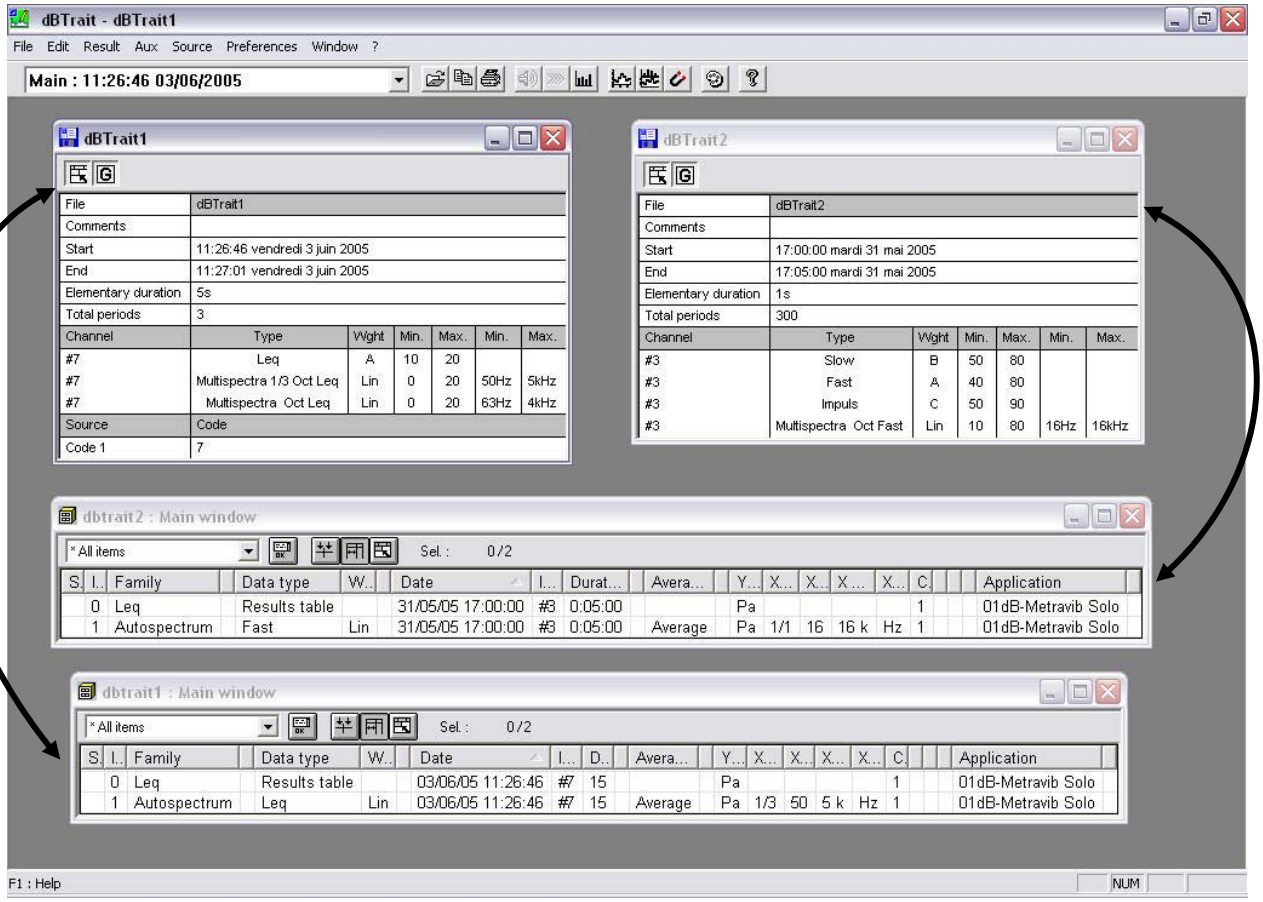
automatically resize column width

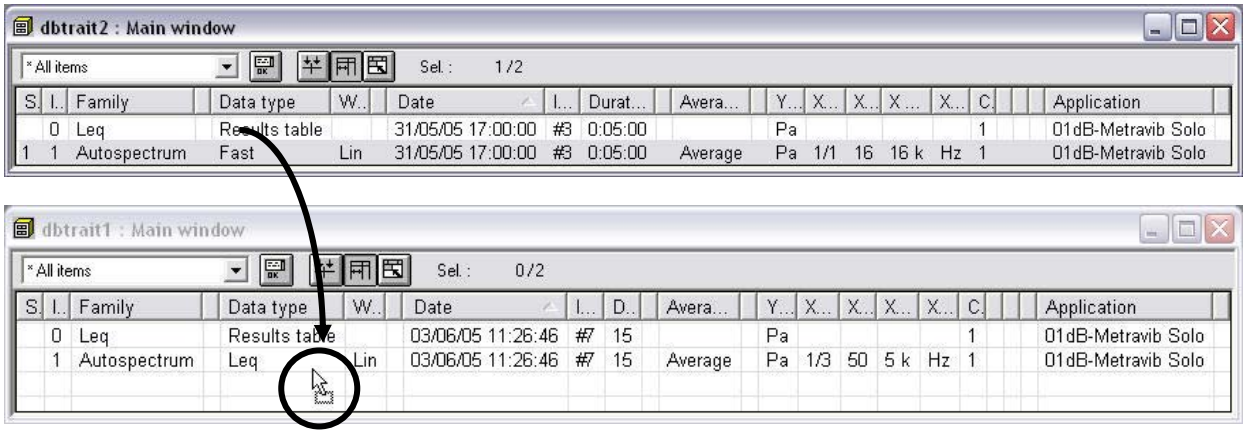
automatically resize window

select column to display:



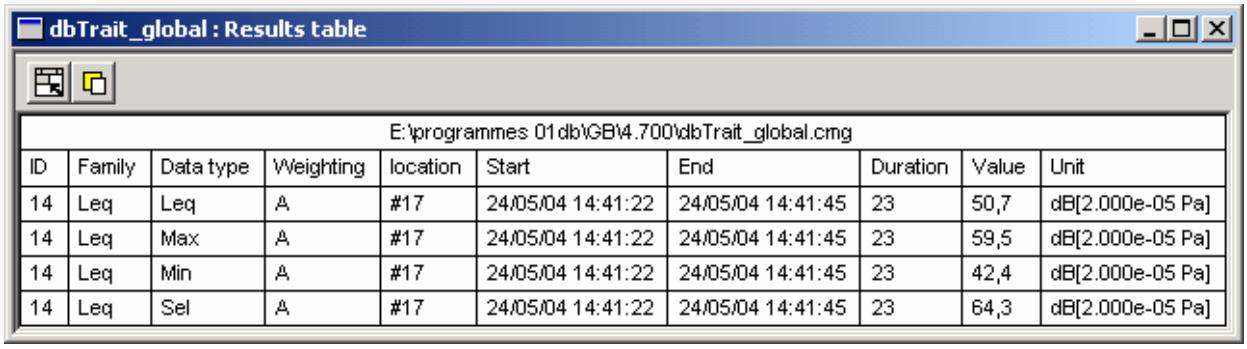
11.1.2.Gestion des différentes fenêtres d'items globaux


dBTrait - dBTrait1
File Edit Result Aux Source Preferences Window ?
Main : 11:26:46 03/06/2005
dBTrait1
File dBTrait1
Comments
Start 11:26:46 vendredi 3 juin 2005
End 11:27:01 vendredi 3 juin 2005
Elementary duration 5s
Total periods 3
Channel Type Wght Min. Max. Min. Max.
#7 Leq A 10 20
#7 Multispectra 1/3 Oct Leq Lin 0 20 50Hz 5kHz
#7 Multispectra Oct Leq Lin 0 20 63Hz 4kHz
Source Code
Code 1 7
dBTrait2
File dBTrait2
Comments
Start 17:00:00 mardi 31 mai 2005
End 17:05:00 mardi 31 mai 2005
Elementary duration 1s
Total periods 300
Channel Type Wght Min. Max. Min. Max.
#3 Slow B 50 80
#3 Fast A 40 80
#3 Impuls C 50 90
#3 Multispectra Oct Fast Lin 10 80 16Hz 16kHz
dbtrait2 : Main window
* All items Sel. : 0/2
S. I.. Family Data type W.. Date I... Durat... Avera... Y... X... X... X ... X... C. Application
0 Leq Results table 31/05/05 17:00:00 #3 0:05:00 Pa 1 01dB-Metravib Solo
1 Autospectrum Fast Lin 31/05/05 17:00:00 #3 0:05:00 Average Pa 1/1 16 16 k Hz 1 01dB-Metravib Solo
dbtrait1 : Main window
* All items Sel. : 0/2
S. I.. Family Data type W.. Date I... D.. Avera... Y... X... X... X... X... C. Application
0 Leq Results table 03/06/05 11:26:46 #7 15 Pa 1 01dB-Metravib Solo
1 Autospectrum Leq Lin 03/06/05 11:26:46 #7 15 Average Pa 1/3 50 5 k Hz 1 01dB-Metravib Solo
F1 : Help
NUM


dbtrait2 : Main window
* All items Sel. : 1/2
S. I.. Family Data type W.. Date I... Durat... Avera... Y... X... X... X ... X... C. Application
0 Leq Results table 31/05/05 17:00:00 #3 0:05:00 Pa 1 01dB-Metravib Solo
1 1 Autospectrum Fast Lin 31/05/05 17:00:00 #3 0:05:00 Average Pa 1/1 16 16 k Hz 1 01dB-Metravib Solo
dbtrait1 : Main window
* All items Sel. : 0/2
S. I.. Family Data type W.. Date I... D.. Avera... Y... X... X... X... X... C. Application
0 Leq Results table 03/06/05 11:26:46 #7 15 Pa 1 01dB-Metravib Solo
1 Autospectrum Leq Lin 03/06/05 11:26:46 #7 15 Average Pa 1/3 50 5 k Hz 1 01dB-Metravib Solo

11.2. Overall values in SOLO

During data transfer, overall values (spectra and tables) are transferred directly into the global items view.



dbTrait_global : Results table

E:\programmes 01db\GB\4.700\dbTrait_global.cmg

ID	Family	Data type	Weighting	location	Start	End	Duration	Value	Unit
14	Leq	Leq	A	#17	24/05/04 14:41:22	24/05/04 14:41:45	23	50,7	dB[2.000e-05 Pa]
14	Leq	Max	A	#17	24/05/04 14:41:22	24/05/04 14:41:45	23	59,5	dB[2.000e-05 Pa]
14	Leq	Min	A	#17	24/05/04 14:41:22	24/05/04 14:41:45	23	42,4	dB[2.000e-05 Pa]
14	Leq	Sel	A	#17	24/05/04 14:41:22	24/05/04 14:41:45	23	64,3	dB[2.000e-05 Pa]

Double click to display the overall values of a transferred measurement session.

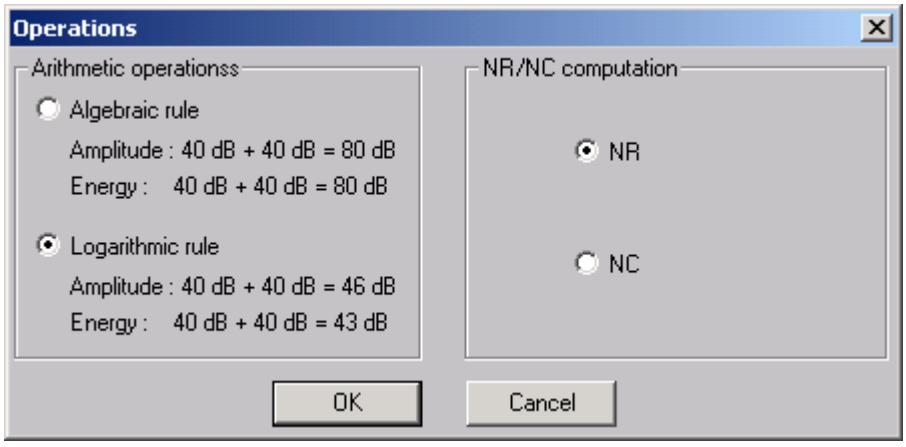
11.3. Spectra added from the spectrum history plot

Click on to add the spectrum currently displayed in the time history view to the list of global items. Calculations can then be performed on this spectrum.

11.4. Calculations on spectra

11.4.1. General preferences

Prior to any calculation, one should specify the type of operation to perform: algebraic or logarithmic. One should also specify whether NR or NC curves are expected. These settings are defined in the **Preferences – Operations** menu.


Operations
Arithmetic operationss
Algebraic rule
Amplitude : 40 dB + 40 dB = 80 dB
Energy : 40 dB + 40 dB = 80 dB
Logarithmic rule
Amplitude : 40 dB + 40 dB = 46 dB
Energy : 40 dB + 40 dB = 43 dB
NR/NC computation
NR
NC
OK
Cancel

11.4.2. Sum, difference, average

To add, subtract or average spectra, just select them in the list and click on the corresponding button. Spectra of the same type should however be selected to perform calculations.

The resulting spectrum is added to the list.

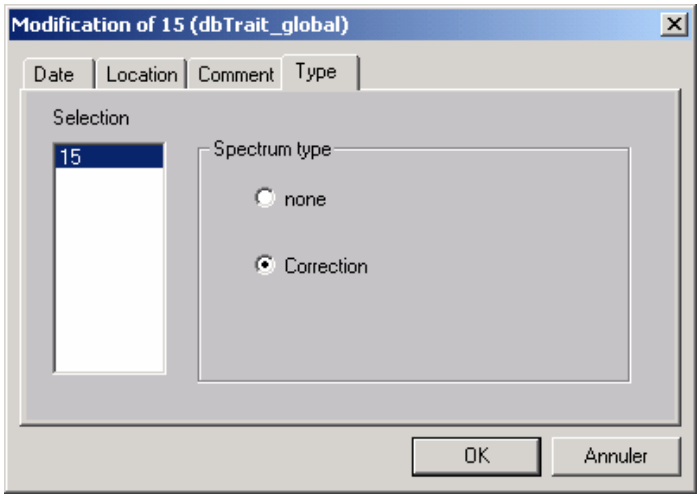
11.4.3. Spectrum correction

To correct a spectrum, a **correction spectrum** is required. There are two possible methods:

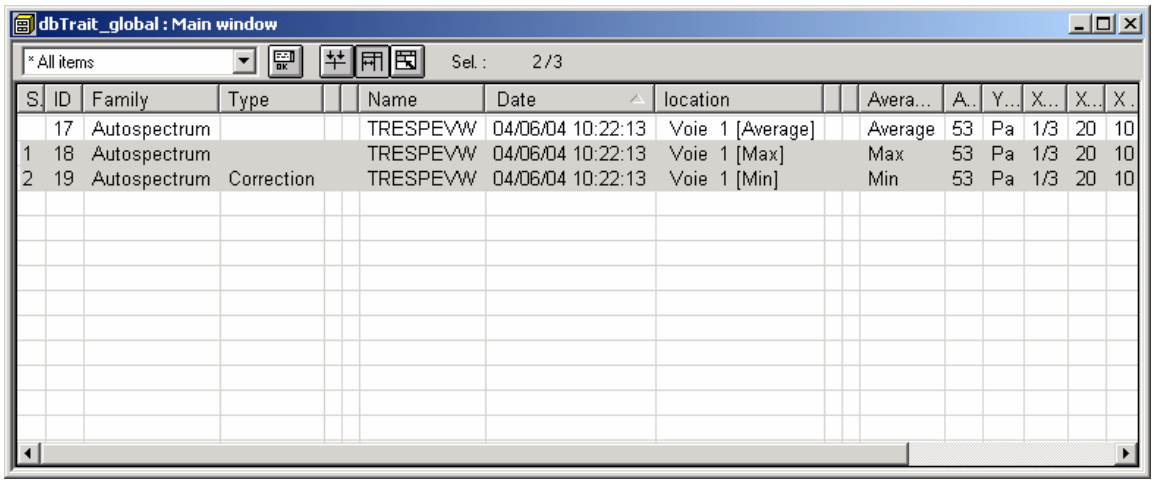
- either use an existing spectrum
- or create a spectrum

In both cases, this spectrum must be of the same type as the spectra to correct.

The spectrum that is going to be used to correct other spectra must be labelled as a correction spectrum. To do so, select the spectrum, click on the "Change" button, and in the "Type" tab select "correction". The type of the spectrum is listed as "Correction" in item view.



Select the spectra to correct, as well as the correction spectrum:


dbTrait_global : Main window
* All items
Sel. : 2/3
S. ID Family Type Name Date location Avera... A.. Y... X... X... X.
17 Autospectrum TRESPEVW 04/06/04 10:22:13 Voie 1 [Average] Average 53 Pa 1/3 20 10
1 18 Autospectrum TRESPEVW 04/06/04 10:22:13 Voie 1 [Max] Max 53 Pa 1/3 20 10
2 19 Autospectrum Correction TRESPEVW 04/06/04 10:22:13 Voie 1 [Min] Min 53 Pa 1/3 20 10

Click on "C" to start the calculation.

Corrected spectrum(a) will be added to the list in the main window.

11.4.4. Spectrum recomposition

A spectrum can be recomposed in octave bands by clicking on .

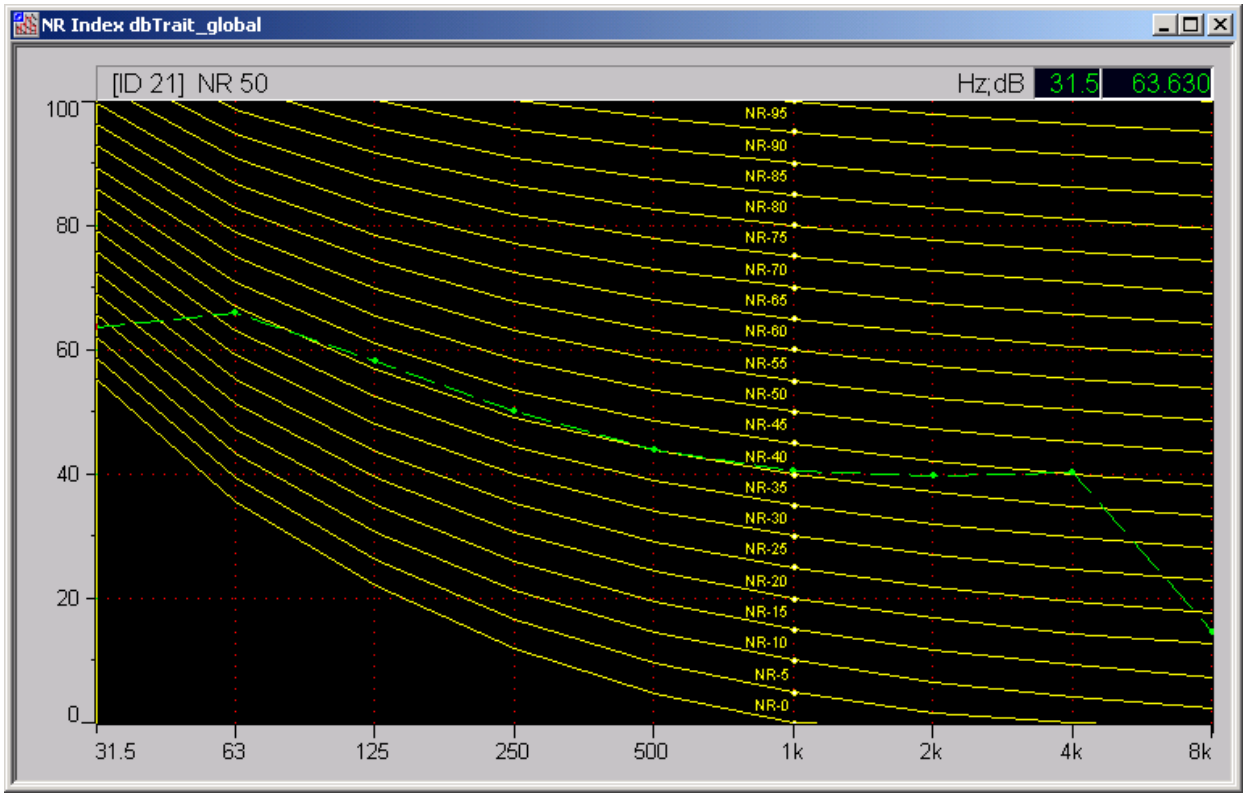
The resulting spectrum will then be added to the list in the main window.

11.4.5. NR/NC curves (option)

To calculate NR or NC curves, the calculation must be performed on an **octave spectrum**.

Click on the corresponding button: .

The result is displayed in the general window. Double click on the item or on the button to plot the result:

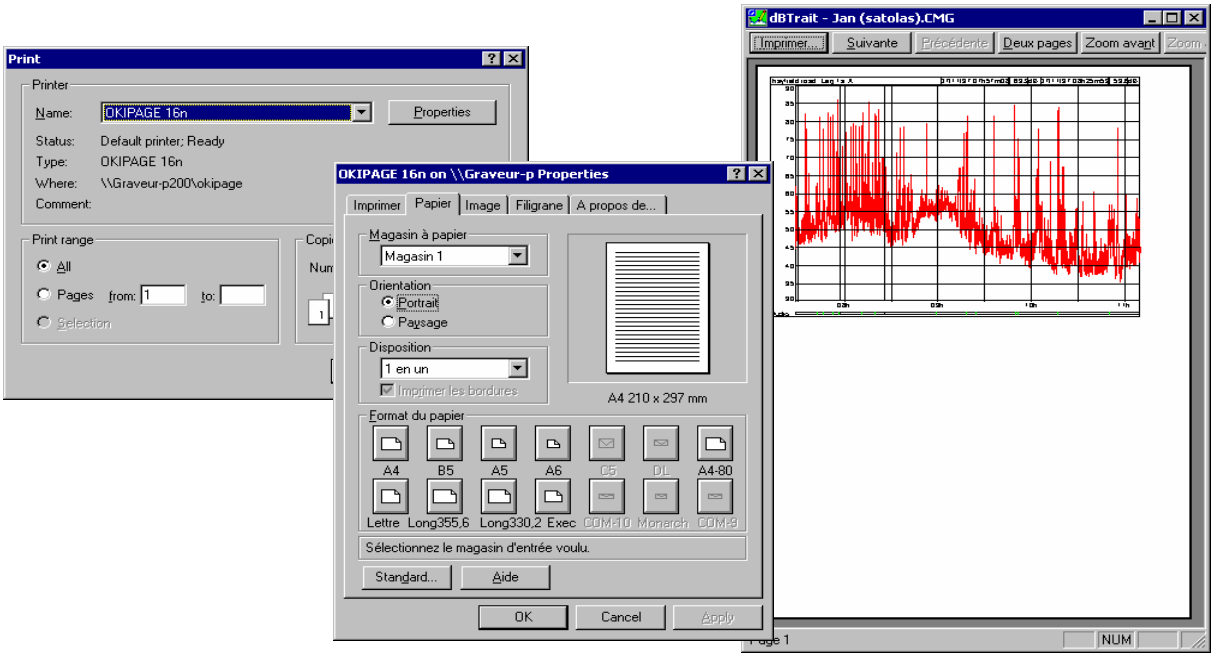


12. RESULT EXPLOITATION & CUSTOMISATION

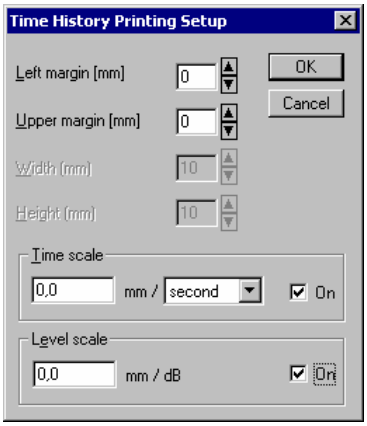
It is possible in **dBTRAIT32** to print directly a time history plot and/or a result listing and to export the results as graphics or values in standard office spreadsheet and word processor software, for further processing and result presentation. The user can also customise the way the data is displayed in the software.

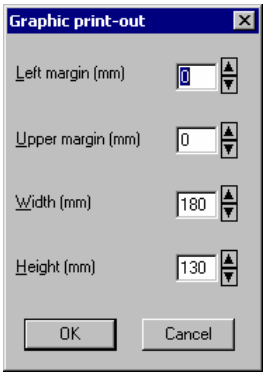
12.1. Printing results

Using the commands of the **File** menu, results can be directly printed by **dBTRAIT32**, if a printer is connected to the computer, of course. Use the command **File / Print** to display the Print dialog box. Specify which pages should be printed, the number of copies, and the printer driver to use as well as other parameters (print quality, etc.)



Access directly to the printer configuration dialog box by the command **File / Print Setup** and to a preview of the document to print by the command **File / Print Preview.** The toolbar of the print preview window allows the user, for example, to zoom in the preview document.





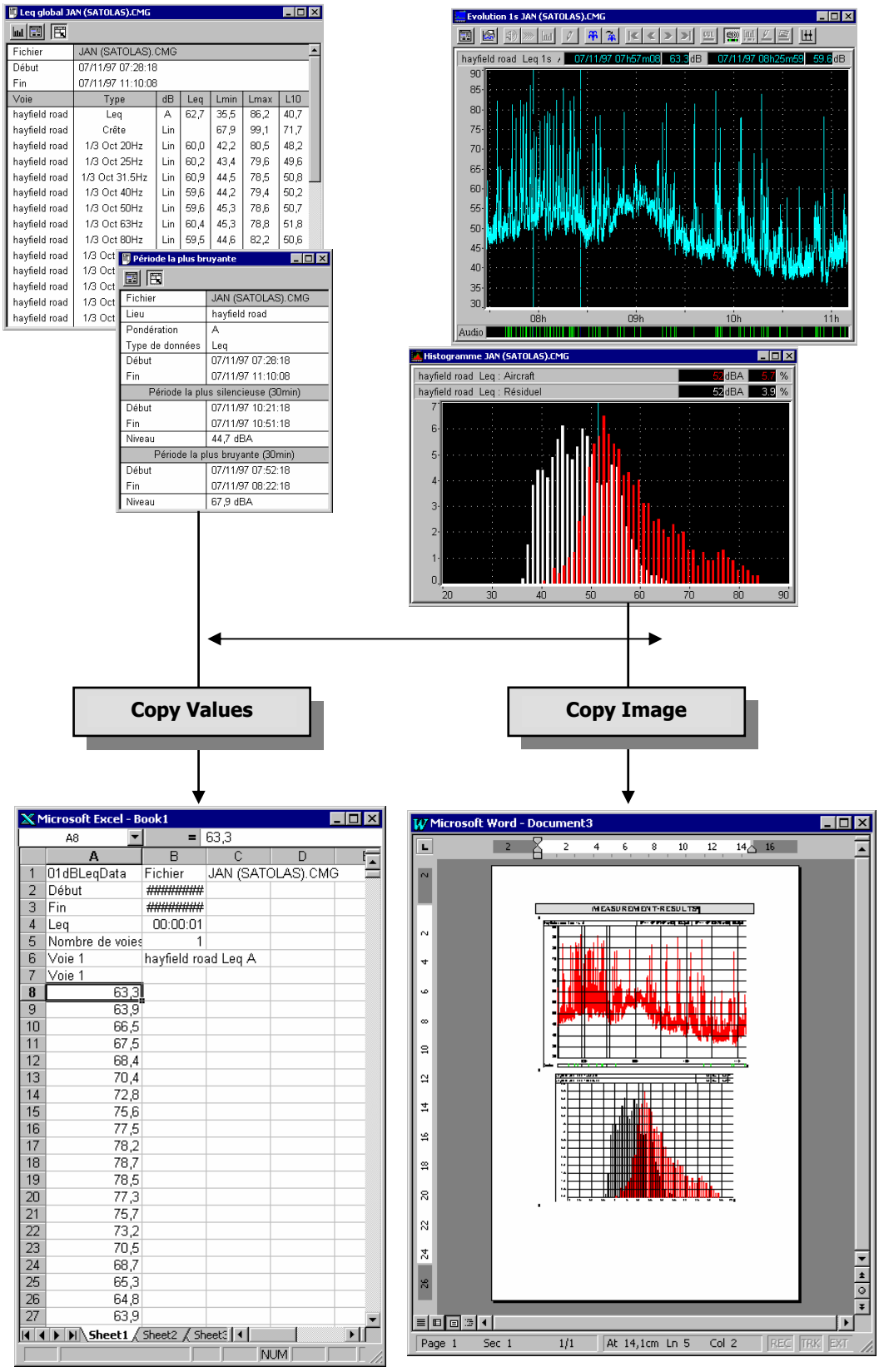
When printing graphics, the user can set a few additional parameters by the **commands Preferences / Graphic printout / Time history** and **Histograms.**

The user can set the margins of the graphic printout frame and, when printing a time history plot, the dimensions (in mm) for the time scale (X-axis) and the level scale (Y-axis).

It is also possible to define the colours of each curves of the printout by using the command **Preferences/ Colours / Printer.** See **paragraph 12.4.**

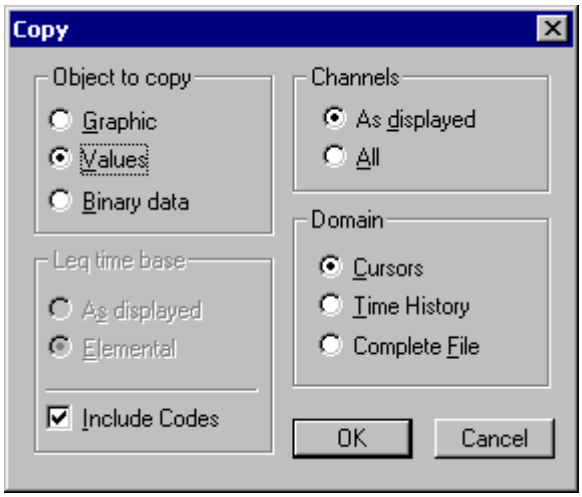
12.2. Exporting data to a spreadsheet and word processors

The user may either export results as graphics (time history plots and results listings) by the command **Edit / copy / Image** or export the results as values by the command **Edit / Copy / Values**. After the copy command of **dBTRAIT32**, simply paste (Edit / Paste) the data in a word processor or a spreadsheet processor as shown below:



12.3. Principle of the copy / paste operation of a time history plot

The configuration dialog box for copying time history plots (command **Edit / Copy**) when the active window is a time history plot) offers three different possibilities for the operation:



- **Copy graphic**

This function directly copies the graph as shown on screen (except for the curve colours that have to be set in a different dialog box). It then can be paste in a word processor.

This functions copies as well the cursors if they are shown on screen

- **Copy values**

This function copies the values of the noise data into a spreadsheet processor. The user may copy the original data values **(Elemental Leq time base)** or the Leq values recomposed according to a greater time base, if used in the time history plot **(Leq time base as displayed).**

The user may also copy the codes' information (tick the box **Include Codes**), all the measurement channels contained in the CMG file **(Channels / All)** or only the ones displayed on the **plot (Channels / As displayed).**

The time domain for copying the noise data can correspond to the **complete file**, the data displayed in the time history or the data contained in between the **cursors**.

- **Copy binary data**

It is the same principle as for copying tabulated values but this command is used to paste the values in a new or an existing CMG file.

This option is mainly used to keep only part of the CMG file (only one measurement channel for example) or to recompose the elemental Leqs according to a greater time base.

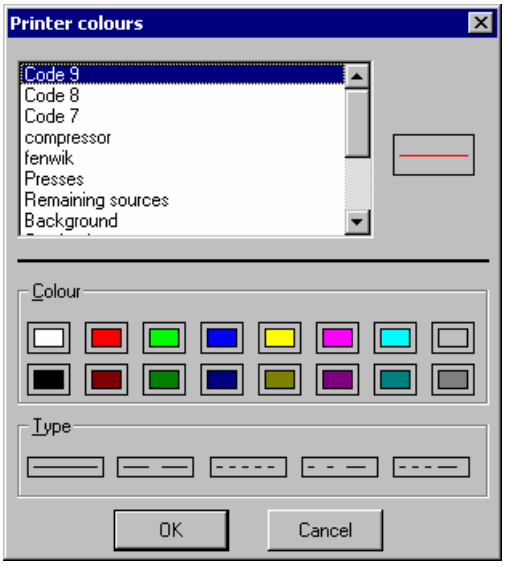
12.4. Customisation of dBTRAIT32

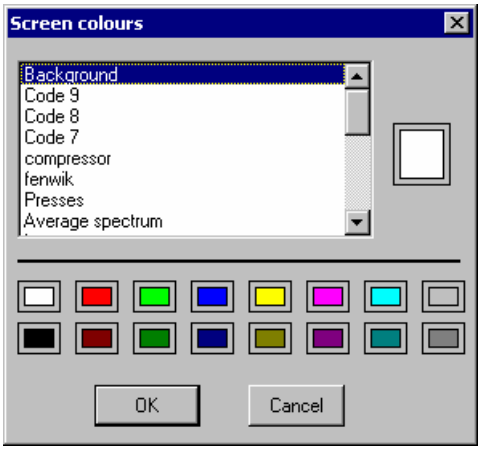
The software allows the user to customise various parameters for displaying the data.

The commands **Preferences / Colours / Screen** and **Preferences / Colours / Printer** allows the user to respectively set the colours of the different types of data displayed on screen or on the printer.

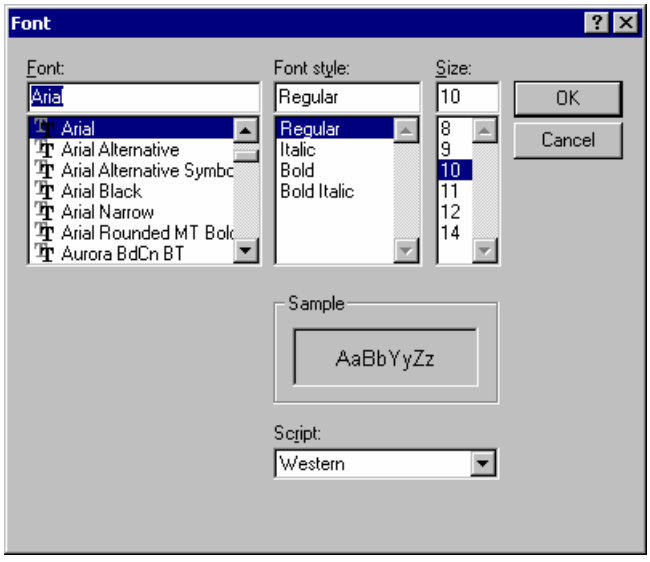
Select in this list the type of data for which you want to modify the colour. The actual colour associated to this type of data is displayed below the list. Then, select with the mouse the new colour.

For the printer colours, the user can also select the **type** of line used for printing a noise quantity.





Click on **OK** when all the modifications have been carried out.



The command **Preferences / Font** allows the user to choose which computer font will be used to display text in **dBTRAIT32**.

Select the font type, style (regular, Italic, Bold, etc.) and size in this dialog box.

Click on **OK** when all the modifications have been carried out.

12.5. Customisation of displacements

Displacements on time history plots and on spectra can be customised.

Reminders on classic displacements:

move to the next page

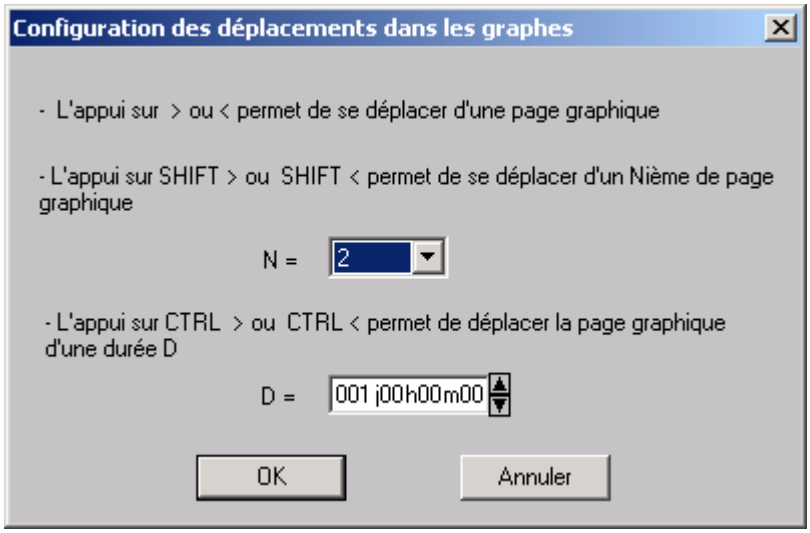
go to last page

go to previous page

go back to first page

Move by Nth of a page or by a defined length of time using keyboard shortcuts.

These parameters are set in the **Preferences – Displacements** menu**:**



- Press SHIFT + to move by an Nth of a screen, according to the predefined settings.
- Press CTRL + to move by a defined length of time.

13. AUTOMATIC PROCESSING (OPTION)

In **dBTRAIT32**, several measurement session datafiles can be analysed **automatically**. The analysis consists of the simultaneous execution of a number of operations defined by the user in a script.

The results of the processing can be displayed on the screen (**Display Simulation**), printed (**Printer**), or sent to a set of files (**Files**). The files containing the results can then be resumed in a word or spreadsheet processor.

The software allows the user to define and save these scripts in files, for later use. A script contains a list of operations to carry out on the CMG files. All the options of the **Display** menu can therefore be assimilated to a single operation and can form part of a script.

An operation of the same type can be part of the script several times with different parameters (e.g. Plot on the time history over a period of one hour and another plot over a period of 10 minutes).

All the operations are completely carried out for the duration of each file. A script is saved in a file whose extension is FAS (File Automatic Script) by default.

13.1. Script capture

The capture only allows the definition of a **new** script. It is not possible to modify an existing one. Each step necessary to define a new script is shown below.

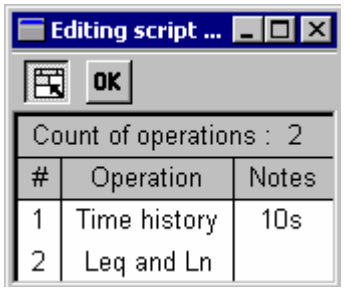
- **Opening a CMG data file**

The definition of a new script is based on the analysis of a CMG file. This file should be representative of the set of files to analyse. The first operation of a script capture is therefore opening a CMG file.

- **Activating the script capture mode.**

Selecting the command **Automatic Processing Script** in the **Preferences** menu does it. The **Editing Script** window is then displayed onto the screen. At first, it indicates that the number of script operations is zero.

- **Defining the script operations**



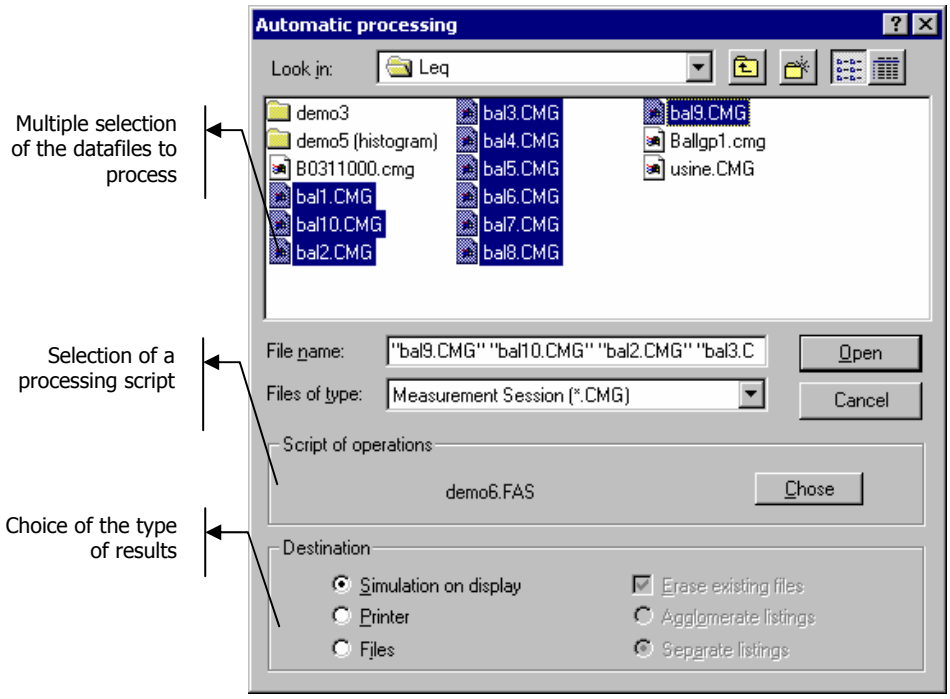
The definition of the script contents is made as the current CMG file is processed. All of the operation parameters are memorised, and a new line is added to the window after each operation. For example, after a spectral time history plot and overall Leq table listing, the window displays the following information.

- **Ending the capture procedure and Saving the script**

Clicking the window **OK** button ends the script capture. The operator can then save the script in a file with FAS extension. The filename choice obeys all the usual Windows rules. The script is saved and is then ready to use.

13.2. Launching of automatic processing

The **Automatic Processing** command in the **File** section launches the processing. Opening a CMG file beforehand is not necessary. The dialogue box to select the analysis parameters is shown below:



The file list allows a multiple selection of CMG files from a specified directory (by clicking on each file and holding the CTRL key down). The selected files are marked in the list and displayed in the capture window (in the visible length limit). The chosen script filename is displayed in the middle of the dialogue box. The **Choose** button allows the user to select another script. A similar dialog box is displayed for selection of the script file.

Only one script can be selected at a time. Three destinations are possible for the results:

13.2.1. Simulation display (on the screen)

It is advised to choose this option first. It allows the user to see on the screen each processing step, file by file and operation by operation. Errors, incompatibilities, incorrect formats can be therefore detected before launching the 'true' processing.

13.2.2. Printing results

Each obtained result will be printed. Usually, a result (table or graph) takes up one page. Some listings, such as **level per period** and **counts**, can take up several pages.

13.2.3. Set of files' results

The results are sent to two types of file: Listings to text files (ASCII) and graphics to metafiles (Window formats).

Due to their simplicity, the text files can be grouped in **agglomerate listings**. This option allows the user to dispose of the same information to a number of lower files.

For **separate listings**, one file will be created for each listing, which can be used for macro commands in spreadsheets or text processors.

The rules for the filenames are shown below:

- **A new sub-directory is created in the data directory**. **It carries the name of the script file**.

For example, if the file to be processed is located in the directory C:\01DB\CMG and the selected script is ALPHA.FAS, the results will be stored in the new directory C:\01DB\CMG\ALPHA.

- **The files containing graphical results carry the CMG filename with the incremental extensions from T00 (T for Trace) followed by two digits starting from 00.**

For example, if a time history and an amplitude distribution make part of the ALPHA.FAS script applied to the files TOTO.CMG and TATO.CMG of the C:\01DB\CMG directory, the files:

- C:\01DB\CMG\ALPHA\TOTO.T000 will contain the time history of the TOTO.CMG file
- C:\01DB\CMG\ALPHA\TOTO.T01 its amplitude distribution
- C:\01DB\CMG\ALPHA\TATO.T00 the time history of the TATO.CMG file
- C:\01DB\CMG\ALPHA\TATO.T01 the amplitude distribution of the TATO.CMG file.

The result filenames are in this case independent of the script filename.

- **If the agglomerate listings option is chosen, the program creates a file by listing operation, with a unique name depending on the type of operation:**

Leq and Ln	LEVELS
Sources	LSOURCES
Leq and Ln per period	LEVELPER
Sources per period	SOURCEPER
Statutory periods	USERPER
Loudest period	LOUDEST
Count	COUNT
Occupational noise	WORKPLAC

- **The extension is .000 for the first operation of a given type in the script, .001 for the second one, etc**.

For example, the grouped listing of the type 'Leq and statistical indices' of a CMG file assembly in the C:\01DB\CMG index, treated by the script ALPHA.FAS will be placed in the file C:\01DB\CMG \ALPHA\LEVELS.000.If the script contains a second listing of this type (with different indices, for example), the results of the operation will be found in the file C:\01DB\CMG\ALPHA\LEVELS.001. The names of the result files are in this case independent of the names of the acoustic data files. As it has been mentioned earlier, no grouping of graphics files is possible.

Important: The files are sorted chronologically if the '*agglomerate listings'* option is chosen, to allow for an easier exploitation of results.

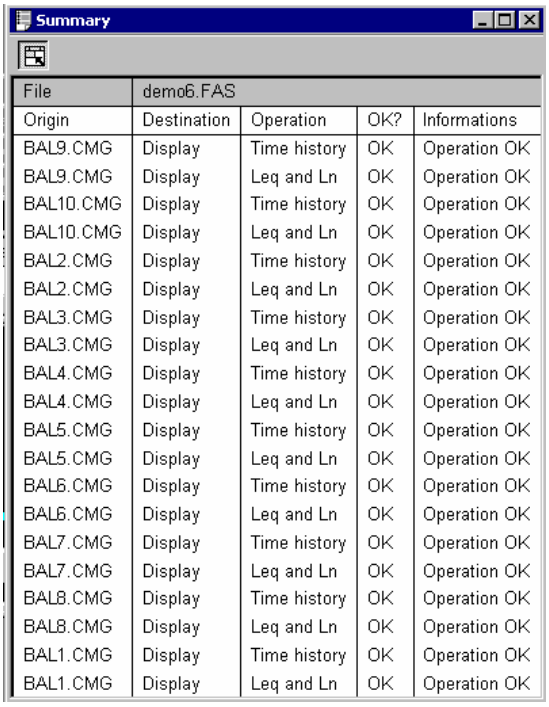
- **If the '*Individual listings'* option is chosen, the names of the result files obey the same procedure as for graphical result files**: a listing file by CMG data file and by script operation. **The only difference is the first letter of the extension**: an L (for Listing) replaces the T (for Trace). The names of the result files are in this case independent of the name of the script file.

For example, if the listings '**Leq and Statistical indices'** and '**Statutory periods'** make part of an ALPHA.FAS script applied to files TOTO.CMG and TATO.CMG in the directory C:\01DB\CMG, the files:

- C:\01DB\CMG\ALPHA\TOTO.L00 will contain Leq and Ln indices of the TOTO.CMG file,
- C:\01DB\CMG\ALPHA\TOTO.L01 'Statutory periods' of the TOT.CMG file,
- C:\01DB\CMG\ALPHA\TATO.L00 'Leq and Ln indices' of the TATO.CMG file and
- C:\01DB\CMG\ALPHA\TATO.L01 'Leq by regulated periods' of the TATO.CMG file.

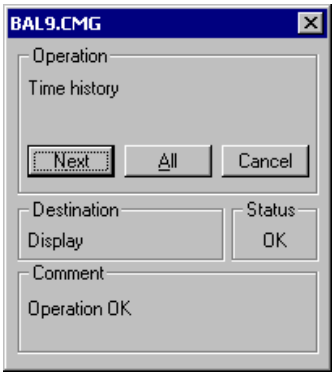
13.3. Processing progress

Once the processing parameters have been defined, **dBTRAIT32** opens, one by one, the files of the selected set and applies, one by one, the script operations. A special window follows the processing.



File	demo6.FAS			
Origin	Destination	Operation	OK?	Informations
BAL9.CMG	Display	Time history	OK	Operation OK
BAL9.CMG	Display	Leq and Ln	OK	Operation OK
BAL10.CMG	Display	Time history	OK	Operation OK
BAL10.CMG	Display	Leq and Ln	OK	Operation OK
BAL2.CMG	Display	Time history	OK	Operation OK
BAL2.CMG	Display	Leq and Ln	OK	Operation OK
BAL3.CMG	Display	Time history	OK	Operation OK
BAL3.CMG	Display	Leq and Ln	OK	Operation OK
BAL4.CMG	Display	Time history	OK	Operation OK
BAL4.CMG	Display	Leq and Ln	OK	Operation OK
BAL5.CMG	Display	Time history	OK	Operation OK
BAL5.CMG	Display	Leq and Ln	OK	Operation OK
BAL6.CMG	Display	Time history	OK	Operation OK
BAL6.CMG	Display	Leq and Ln	OK	Operation OK
BAL7.CMG	Display	Time history	OK	Operation OK
BAL7.CMG	Display	Leq and Ln	OK	Operation OK
BAL8.CMG	Display	Time history	OK	Operation OK
BAL8.CMG	Display	Leq and Ln	OK	Operation OK
BAL1.CMG	Display	Time history	OK	Operation OK
BAL1.CMG	Display	Leq and Ln	OK	Operation OK

One line is added after each operation. This window remains displayed after the end of the processing as it constitutes the processing report.



Each operation is first executed on-screen, independently of the result destination. The results are then transferred to a printer or a file.

If the destination is the screen, it first stops, with the results displayed and a message for the user to continue

This logic allows a review of all the operations before printing or saving in exit files. The **Next** button continues with the next operation. The **All** button execute all the other script operations on all the selected files. The **Cancel** button interrupts the script. After the last operation, the current file is closed (and the on-screen results erased) except if this file was opened before the processing launch.

At the end of the processing (after the last operation on the last file) the window entitled '**Summary'** can be consulted to check the script process. This window can be printed or transferred into another application via the copy/paste function.

13.3.1.Leq statistical indices : privileged operation

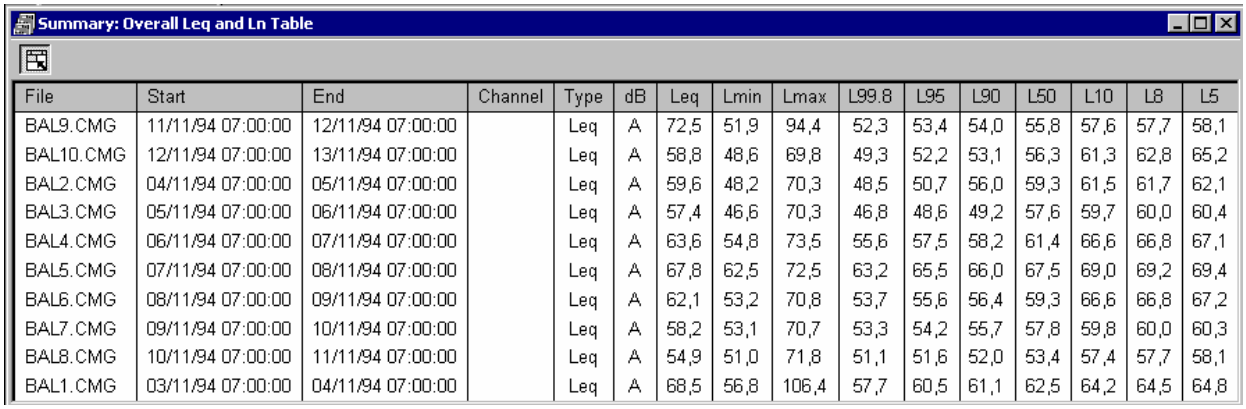
The listing of the type **Leq and statistical indices** is the basis of all data file analysis. It is particularly important for the analysis of files obtained from long on-site measurements.

To make the results more easy to use, the listing format **Leq and statistical indices** changes for the automatic processing. It is presented under the form of a line per file channel. In particular, for the treatment of a single channel, each data file is listed in a single line. The choice of agglomerate listings allows the piling up of lines in the same text file.

Let us take the example of a 9-day noise measurement, split into 24-hour files. The script contains the "Leq and Ln" operation, with a day by day (file by file) listing option:

File	Start	End	Channel	Type	dB	Leq	Lmin	Lmax	
BAL9.CMG	**11/11/94 07:00:00**	**12/11/94 07:00:00**			**Leq**	**A**	**72,5**	**51,9**	**94,4**
BAL10.CMG	**12/11/94 07:00:00**	**13/11/94 07:00:00**			**Leq**	**A**	**58,8**	**48,6**	**69,8**
BAL2.CMG	**04/11/94 07:00:00**	**05/11/94 07:00:00**			**Leq**	**A**	**59,6**	**48,2**	**70,3**
BAL3.CMG	**05/11/94 07:00:00**	**06/11/94 07:00:00**			**Leq**	**A**	**57,4**	**46,6**	**70,3**
BAL4.CMG	**06/11/94 07:00:00**	**07/11/94 07:00:00**			**Leq**	**A**	**63,6**	**54,8**	**73,5**
BAL5.CMG	**07/11/94 07:00:00**	**08/11/94 07:00:00**			**Leq**	**A**	**67,8**	**62,5**	**72,5**
BAL6.CMG	**08/11/94 07:00:00**	**09/11/94 07:00:00**			**Leq**	**A**	**62,1**	**53,2**	**70,8**
BAL7.CMG	**09/11/94 07:00:00**	**10/11/94 07:00:00**			**Leq**	**A**	**58,2**	**53,1**	**70,7**
BAL8.CMG	**10/11/94 07:00:00**	**11/11/94 07:00:00**			**Leq**	**A**	**54,9**	**51,0**	**71,8**
BAL1.CMG	**03/11/94 07:00:00**	**04/11/94 07:00:00**			**Leq**	**A**	**68,5**	**56,8**	**106,4**

We talked about the format of results sent to the agglomerate file. The listing of type **Leq and statistical indices** benefits from a complimentary privilege: the agglomerate listing is presented entirely formatted on the screen independently of the choice of exit destination. In other words, even after a simulation on the screen, the results of this type are displayed (data as for preceding example):



File	Start	End	Channel	Type	dB	Leq	Lmin	Lmax	L99.8	L95	L90	L50	L10	L8	L5
BAL9.CMG	11/11/94 07:00:00	12/11/94 07:00:00		Leq	A	72,5	51,9	94,4	52,3	53,4	54,0	55,8	57,6	57,7	58,1
BAL10.CMG	12/11/94 07:00:00	13/11/94 07:00:00		Leq	A	58,8	48,6	69,8	49,3	52,2	53,1	56,3	61,3	62,8	65,2
BAL2.CMG	04/11/94 07:00:00	05/11/94 07:00:00		Leq	A	59,6	48,2	70,3	48,5	50,7	56,0	59,3	61,5	61,7	62,1
BAL3.CMG	05/11/94 07:00:00	06/11/94 07:00:00		Leq	A	57,4	46,6	70,3	46,8	48,6	49,2	57,6	59,7	60,0	60,4
BAL4.CMG	06/11/94 07:00:00	07/11/94 07:00:00		Leq	A	63,6	54,8	73,5	55,6	57,5	58,2	61,4	66,6	66,8	67,1
BAL5.CMG	07/11/94 07:00:00	08/11/94 07:00:00		Leq	A	67,8	62,5	72,5	63,2	65,5	66,0	67,5	69,0	69,2	69,4
BAL6.CMG	08/11/94 07:00:00	09/11/94 07:00:00		Leq	A	62,1	53,2	70,8	53,7	55,6	56,4	59,3	66,6	66,8	67,2
BAL7.CMG	09/11/94 07:00:00	10/11/94 07:00:00		Leq	A	58,2	53,1	70,7	53,3	54,2	55,7	57,8	59,8	60,0	60,3
BAL8.CMG	10/11/94 07:00:00	11/11/94 07:00:00		Leq	A	54,9	51,0	71,8	51,1	51,6	52,0	53,4	57,4	57,7	58,1
BAL1.CMG	03/11/94 07:00:00	04/11/94 07:00:00		Leq	A	68,5	56,8	106,4	57,7	60,5	61,1	62,5	64,2	64,5	64,8

This is a standard list of **dBTRAIT32**: it can be printed or transferred by a simple copy/paste action to another application without recourse to particular importation of text or table processors.

🕮 *There will be as many summary windows as listing operations 'Leq and Ln indices' in the script.*

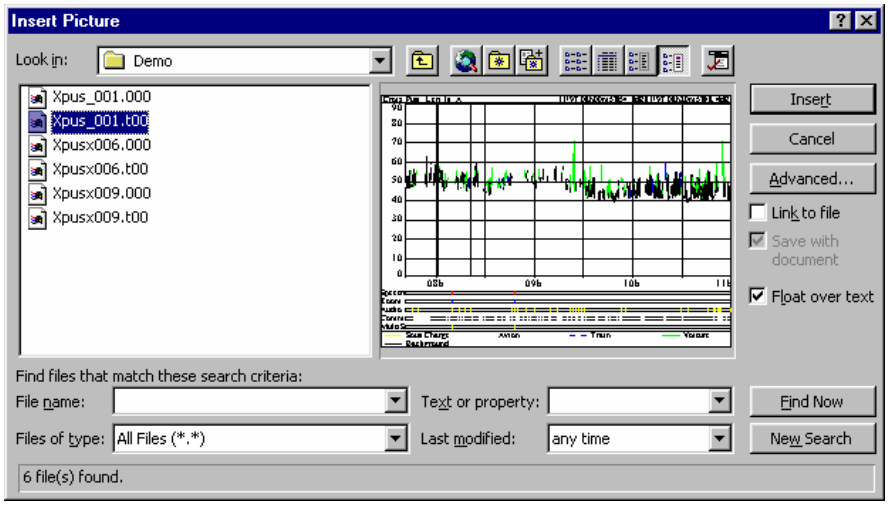
13.4. Resumption by spreadsheet or word processors

13.4.1. Resumption of graphical results

Reminder: The graphical results are stored in the files having the name of the acoustical data file with the extensions T00, T01 etc., and they are found in the sub-directory of the data index carrying the script file name.

These files are in the Windows metafile format. Usually, Windows attaches the extension .WMF to files of this type. The complexity of the automatic analysis file manager leads us to choose non-standard extensions. Nevertheless, the WMF format is respected and the resumption does not present any difficulties, it is sufficient to explicitly state the file extension.

For example, here is a spectral time history resulting from the automatic processing progress. Use the command **Insert / Picture** in Word to insert it in a report:



13.5. Helpful advice

An erroneous definition can lead to parameter changes of an operation, or even to the impossibility of its execution. To minimise the possibility of errors it is advised:

- **To make a preliminary simulation**. Errors can be detected one by one, and the script can therefore be redefined.
- **To define the script using a file as close as possible to the file assembly which will be treated**. *Simple example*: an operation designed for channel 2 of a file to multiple files (Leq, Fast, Peak, and frequency data...) will produce an error if the script is applied to a mono channel file.
- **To pay particular attention to sources**: the numbers of the codes must be identical for a correct processing.
- **To not change the dBTRAIT32 environment.** For example, the listing '*Leq by statutory periods'* can lead to an error if the periods concerned have been erased between the moment of the script definition and the moment of analysis.

13.6. Errors and warnings

Information concerning errors (operation impossible) and warnings (operation done with modified parameters) appear in the '**info'** rubric of the '**summary'** window at the end of the processing. They also appear in the confirmation dialogue box after each operation, in the case of screen simulation. The errors are marked as **ERR** and the warnings as **'!'**.

The list of errors and warnings are shown below:

Message: Operation OK **Type: OK**
No comments.

Message: Not Enough Memory **Type: ERR**
Fatal error. Close any application not necessary or define the script with fewer operations.

Message: Error access destination file **Type: ERR**
The disk is full or protected. Erase files not necessary, change the disk or remove the protection.

Message: Incorrect Parameters **Type: ERR**
The script cannot load the parameters of the current operation. Define the script again. Check that the file has not been modified to avoid the same problem in the future.

Message: Unknown Operation **Type: ERR**
The script continues with an operation that is not recognised by **dBTRAIT32**. There are two possible reasons: the operation in question is not available in your configuration (are you using the script of a colleague?) or the script was modified.

Message: Erroneous Sources **Type: ERR**
None of the requested sources could be found in the opened file. This error appears in operations whose development 'without sources' is impossible (ex: particular source levels)

Message: Erroneous Periods **Type: ERR**
None of the regulated periods specified in the script could be supplied by **dBTRAIT32**. This error will appear for the listing by statutory periods for all the selected files. It is due to a change of period definition between the moment where the script was defined and the present analysis. Capture the periods and redefine the script.

Message: Erroneous Channels **Type: ERR**
The operation concerns channels that do not exist in the file. The script has been defined on the basis of a file having more channels than the file currently been processed. Redefine the script on the representative base file.

Message: Execution Impossible **Type: ERR**
An error appeared during the execution. This could be due to an interruption by the operator during a long operation, or an incompatibility of a calculated result (e.g.: no valid data)

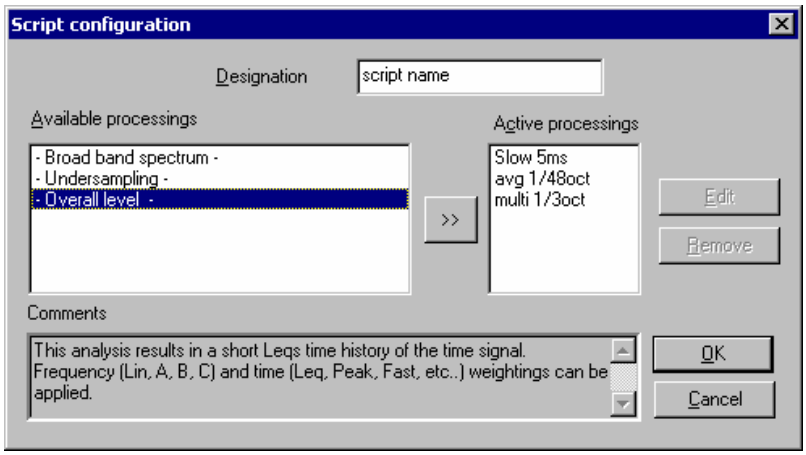
Message: Modified Parameters **Type:!**
Reserved for future use

Message: Modified Sources **Type: !**
The requested operation could not be applied with the requested source assembly. Only the available sources were taken. In the case of operations able to be developed without sources (e.g.: Time history) this message appears even if no sources were found. Redefine the script for the representative base file, having the same sources as the treated file.

Message: Modified Period Duration **Type: !**
The requested operation could not be developed with the requested period. This is due to an incompatibility of period duration. For example, the plot by 5-second periods is not possible in the case of a file having an elementary period of 10 seconds, nor 3 seconds. The duration is adjusted.

14. ONLINE ANALYSIS OF AUDIO RECORDS (OPTION)

It is possible to user to analyse, in both frequency and time domains, audio records made with the software **dBTRIG32** either automatically at the time of acquisition in **dBTRIG32** or at the processing stage in **dBTRAIT32**, using the multitasking capabilities of Windows:



The analysis types are:

- Frequency analysis (averaged spectrum over the audio event duration) in octaves, 1/3rd octaves
- Frequency analysis in 1/6th, 1/12th, 1/24th and 1/48th octaves **(option)**
- Decimation or deletion of audio records to optimise audio storage capacity on the PC hard disk.
- Multispectrum analysis of audio records (spectrum time history and A, Lin overall levels) **(option)**
- Detailed time history (A, C and Lin in parallel, several time constants - Fast, Slow, Impulse, etc. – using very small time step,) **(option)**

You can then evaluate tagged noise data using **dBTRAIT32** - which permits detailed analysis of the noise climate in both time and frequency domains.

All these analyses are available through an **operation (script) server**, common to all 32-bit 01dB application software packages. The definition and configuration of such analyses can be accessed through the command **Aux / Frequency analysis & advanced processing / Configure** in **dBTRAIT32** and **Audio Analysis / Configure analysis**, key **scripts' edition** in **dBTRIG32**. The dialog box shown above is displayed on-screen.
The user then defines an analysis script that consists of a list of processings that will be applied to each audio event. For each type of processing (defined also as an operator), the user sets various parameters.

This utility saves time as you will not have to process the audio recordings manually any more. Furthermore, the multispectrum analysis is ideal for tonal components, which vary in frequency and level.

🕮 *If the option cannot be accessed, it means that the CMG datafile does not contain any audio recordings.*

On validation of the configuration dialog box, the audio data analysis may be started in **dBTRAIT32** by different commands:

- **Multiple processing from the Aux. menu**

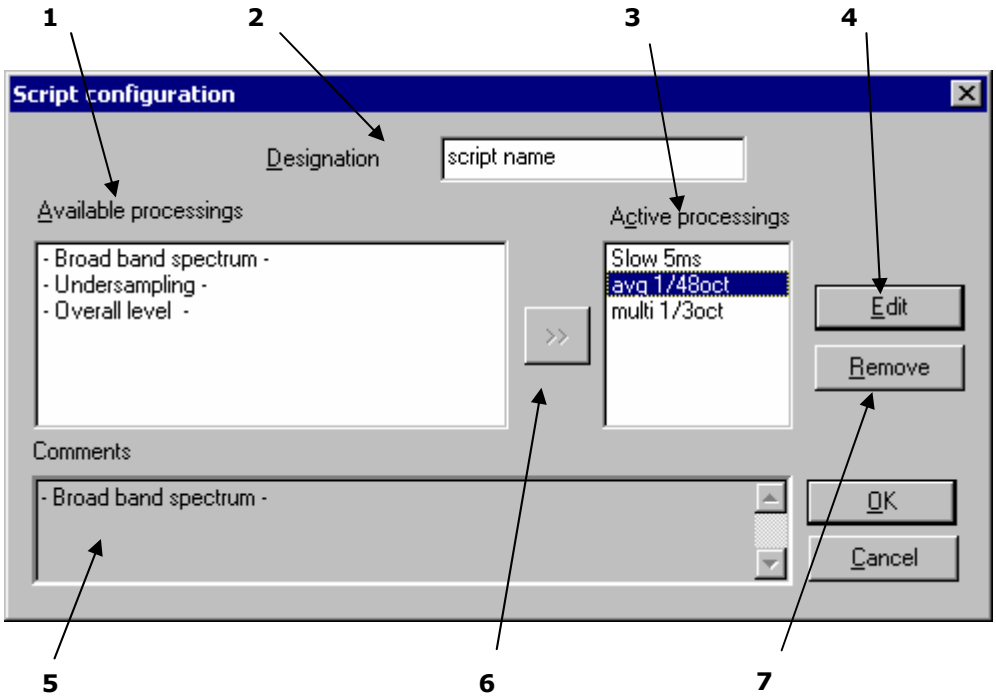
Use the command **Aux. / Frequency analysis & advanced processing / Run.** Another dialog box is displayed on screen. Simply select the audio recordings to process in the given list. To stop the process, use the command **Aux. / Frequency analysis & advanced processing / Abort.**

- **Single processing from the time history plot**

Use the commands described in the **paragraph 4.5.**

14.1. How to define and configure a script

In order to define the list of processings to apply to audio records, access this dialog box (command **Aux / Frequency analysis & advanced processing / Configure** in **dBTRAIT32** and **Audio Analysis / Configure analysis**, key **scripts' edition** in **dBTRIG32**):



1. List of **available processings**: it shows all the types of processings compatible with the software packages **dBTRIG32** and **dBTRAIT32**. The same operator can be used several times with different parameters to process the same audio recording.

2. **Designation**: give a name to the script.

3. Set of **active processings** currently part of the script. These operators will be activated to analyse independently a set of audio events.

4. **Edit** the parameters of the selected operator (in the list of available processings). Each operator shows his/her own configuration dialog box.

5. Comments describing the operator selected in the available processings' list. If an operator from the active processings' list is selected, the comment field shows the type of the operator.

6. **Key >>** that allows to add an operator into the active processings' list. Different operators of the same type may be added (the user may for example define a multispectrum analysis in third octave band with different time steps). A generic name for each operator is given by default.

7. The key **remove** allows the user to remove an operator from the list of the active processings.

Once the list of active processings has been defined, edit each one of them to define the calculation parameters.

14.2. Configuration of each active processing.

Once the list of active processings has been defined in the script configuration dialog box, define the calculation parameters of each operator.

To do so, select an operator in the list and click on the **Edit** key.

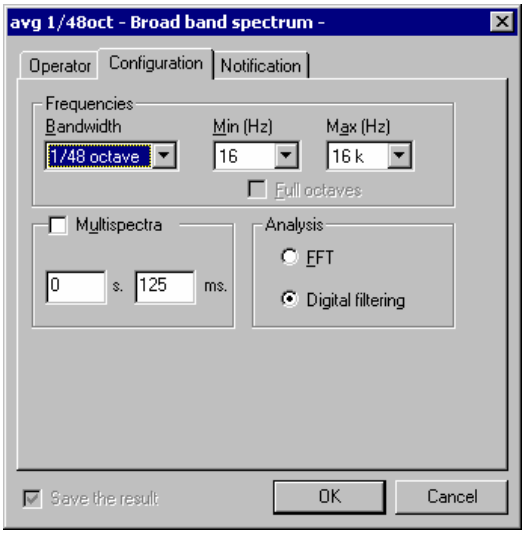
An operator applies a given processing on a quantity or a set of quantities (audio data in the present application software). Each type of operator has its own name and a set of analysis parameters. Furthermore, The progress of each calculation is shown to the user at user-defined intervals.

In **dBTRIG32** and **dBTRAIT32**, the following operators may be selected:

- Broad band spectra (averaged spectra et multispectra)
- Audio record undersampling
- Detailed time history of an overall level

14.2.1. Broad brand analysis (averaged spectra and multispectra)

In the script configuration dialog box, select an operator of type - **octave and third octave spectra -** or, if you have the 1/N octaves option, **- Broadband spectrum -** in the list of available processings and place it in the list of active processings. On operator of name FC is then created.
Select this operator and click on the **Edit** key. The dialog box shown below is displayed on screen. The tab **Operator** gives a detailed description of the operator and allows the user to define a more specific name for it.



In the tab **Configuration**, the following analysis parameters may be defined:

- **Bandwidth** to define the spectrum bandwidth for the analysis: Octaves and 1/3 octaves by default, 1/1, 1/3, 1/6, 1/12, 1/24 and 1/48th octaves in option.
- **Min** : Minimum centre frequency of analysis
- **Max** : Maximum centre frequency of analysis
- **Full octaves:** If this option is activated, the software will set the minimum and maximum frequency limits so that only full octaves are calculated.
- **Analysis**: Select the method used to perform frequency analysis: FFT or digital filtering.

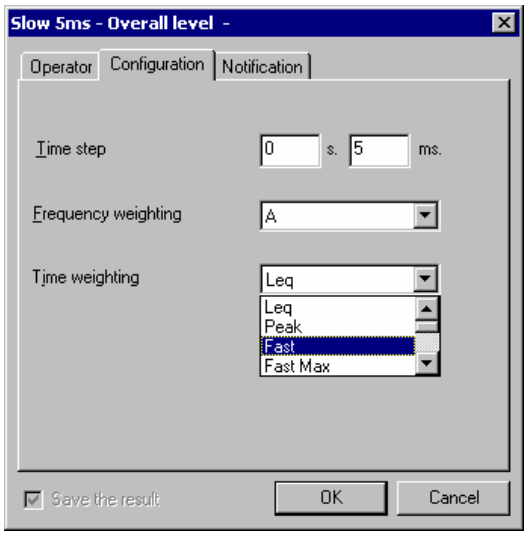
- **Multispectra**: If this option is activated, the user will obtain the time history over the event duration of the calculated spectrum. The time step may vary from 1ms to 1 s.

Furthermore, The choice of maximum frequency for the analysis will depend upon the sampling frequency (approximately twice the measurement pass band) at which the measurements have been taken from **dBTRIG32**: if a pass band of 10 kHz was defined for audio records, frequency bands greater than this cannot be obtained.

14.2.2. Overall level analysis (detailed time history)

A detailed time history analysis offers a zoom facility for the time history data over the duration of the event.

In the script configuration dialog box, select an operator of type **- Overall level -** in the list of available processings and place it in the list of active processings. On operator of name LEQ is then created.
Select this operator and click on the **Edit** key. The dialog box shown below is displayed on screen. The tab **Operator** gives a detailed description of the operator and allows the user to define a more specific name for it.



In the tab **Configuration**, the following analysis parameters may be defined:

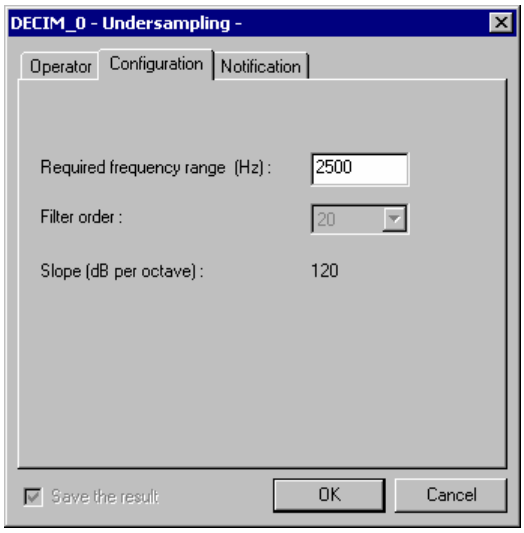
- **Time step**: it is the integration time for the calculation of an overall Leq level. It may vary between 1 ms and 1s.
- **Frequency weighting** : select a frequency weighting to calculate the overall level (A, B, C, Lin)
- **Time weighting** : select the overall noise quantity to calculate (Leq, Peak, Slow, Fast, Impulse)

If, for example, a time step of 1 s is chosen for a 2 s long audio recording, only two values will be calculated (one value per second). The result will therefore be useless. It is recommended to specify as small a step as possible without increasing calculation time too much.

Excessive calculation time may cause problems if the computer has insufficient power. This should also be remembered with respect to the number of quantities and weightings involved in the calculation.

14.2.3. Undersampling

In the script configuration dialog box, select an operator of type **- Undersampling -** in the list of available processings and place it in the list of active processings. On operator of name DECIM is then created.
Select this operator and click on the **Edit** key. The dialog box shown below is displayed on screen. The tab **Operator** gives a detailed description of the operator and allows the user to define a more specific name for it.



In the tab **Configuration**, the following analysis parameters may be defined:

- **Required frequency range**: define the maximum frequency of the audio event after undersampling.

It is recommended not to undersample audio files below 2000 Hz unless source recognition, by playing back the file, is unimportant.

The size of audio recordings, in term of memory space, depends on the pass band declared in the configuration box. A table shows the size in kilobytes of audio records as a function of the pass band.

Even if audio files have been analysed at the time of acquisition, you may process them again, with different parameters, in **dBTRAIT32.** It is therefore recommended not to undersample the audio files in **dBTRIG32** since the sampling rate becomes the upper band limit for a further analysis.

The audio file decimation factor is equal to the ratio of measurement frequency and under-sampling rate. Be aware that only whole integers multiples of 2 or 5 are taken into account. The following results are valid for audio records of 10 s long with a passband of 20 kHz. The equivalent sound pressure level measurements are integrated over a time period of 500 ms.

Frequency pass band (Hz)	decimation factor	decimated file sizes (kilobytes)
20000 ⇒ 10001	0	1001*
10000 ⇒ 5001	2	501
5000 ⇒ 4001	4	251
4000 ⇒ 2001	5	201
2001 ⇒ 1001	10	101
1000 ⇒ -	-	63 **

* original size of the file
** minimum size

To playback decimated audios file, unless the same hardware is used for recording and playback of the audio signal, some problems may be encountered.

This is due to the sampling rate of standard multimedia cards (44,1 kHz standard), which is inferior to **SYMPHONIE** system- when a 20 kHz passband is chosen (f_e = 51.2 kHz). A file decimation factor of at least 2 will be used to play them back on a standard multimedia card.

📖 *The minimal undersampling passband for 01dB hardware is 1414.21 Hz. Any signal decimated below this frequency cannot be played back. Typically, a 2 kHz cut-off frequency is also the minimum required to accurately identify events in environmental noise.*

14.2.4.Gain optimization

15. HIDDEN FUNCTIONS OF DBTRAIT32

In **dBTRAIT32**, there are two 'hidden' functions that :

- set the resolution of statistical indices (Leq and Ln)
- and set the parameters for counting sources events.

These parameters can only be set in the **[Settings]** section of the **dBTRAIT.INI** file. They cannot be accessed directly by a software command.

15.1. Statistical indices' resolution

The statistical indices in **dBTRAIT32** are calculated with a resolution of 0.5 dB by default. One may have noticed that in some listings, the Lmax value was inferior to the L0 value. This is due to calculus limits in the base class of the indices (L0 is rounded to the nearest approximate value), Lmax being calculated with the 'true' values of the data file.

The 0.5dB resolution limit was originally defined to save computer memory. For a file between 20 and 100 dB, a histogram (the basis of any statistical calculus) with a resolution of 0.1dB will take up to 3204 bytes of computer memory (801 data values per measurement channel). If this calculus has to repeat for many consecutive periods, the memory requirements will be even larger.

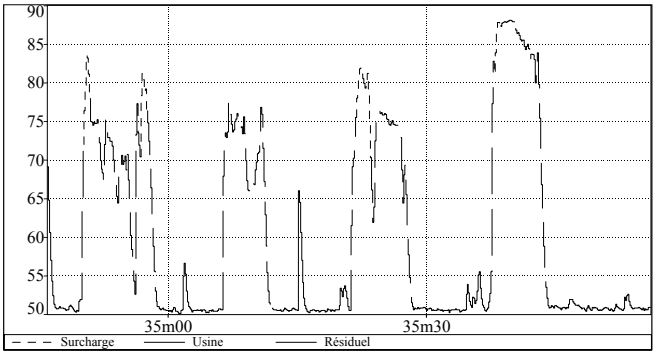
A 0.5 dB resolution reduces the memory needs by a factor 5. Experience shows that this limit is never a problem, as statistical results can take another approximation.
However, it is possible to have a better resolution, down to 0.1dB, for the storage of LEQ files. It can be defined under the line **"LnResolution"** of the **[Settings]** section of the **dBTRAIT.INI** file. For example, to obtain the smallest resolution 0.1 dB, this section will be:

[Settings]
...
...
LnResolution=1
...
...

The contrary (resolution superior to 0.5 dB) is also possible. If your computer shows problems when calculating statistical indices (example: indices every minute for one week of data), the result accuracy can be decreased to reduce the memory needs of the computer. For a 2-dB resolution, the [**Settings**] section will be written as follows:

...
...
LnResolution=20
...

15.2. Sources' count



Consider a measurement where sources are coded but with overload risks. The events we are interested in may be affected by overload events.

From the graph, we can see that the "**Usine**" event appears 4 times in the period represented. The event count gives the following result:

Fichier	GLOK_001.CMG			
Source	Usine			
Lieu	Mein Büro Fast			
Pondération	LIN			
Début	11:34:46:000 15/04/96			
Fin	11:35:56:000 15/04/96			
Apparition	Durée	Leq	Lmax	SEL
11:34:49:375 15/04/96	0:00:00:875	64.3	72.0	63.8
11:34:51:000 15/04/96	0:00:05:875	71.7	77.3	79.4
11:34:57:625 15/04/96	0:00:01:500	67.3	74.8	69.1
11:35:05:750 15/04/96	0:00:06:375	72.1	77.5	80.1
11:35:21:000 15/04/96	0:00:00:875	70.0	75.5	69.5
11:35:22:625 15/04/96	0:00:00:250	80.2	80.5	74.3
11:35:23:625 15/04/96	0:00:04:875	73.4	76.3	80.3
11:35:37:000 15/04/96	0:00:00:875	75.4	82.8	74.9
11:35:38:625 15/04/96	0:00:01:000	87.8	88.0	87.8
11:35:40:500 15/04/96	0:00:04:000	82.7	86.5	88.7
Total: 10	0:00:26:500	78.1	88.0	92.3

The counting configuration can be set to avoid this problem. Any event with a code value of 2 (overload) should not be considered as discontinuity of the source considered. A line **"ContinuousSource"** should therefore be added into the **[Settings]** section of the **dBTRAIT.INI** file :

[Settings]
...
...
ContinuousSource=2
...
...

The listing will then be:

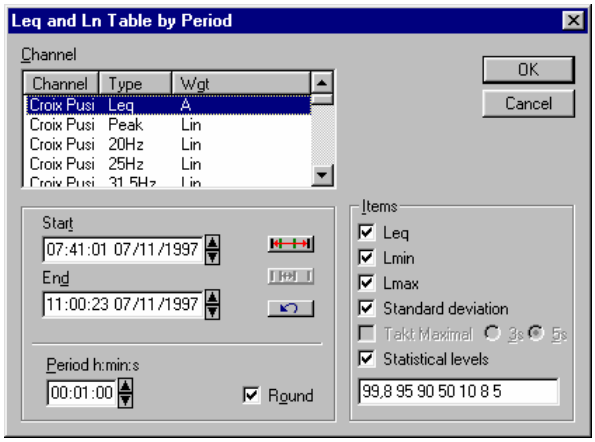
Fichier	GLOK_001.LEQ			
Source	Usine			
Lieu	Mein Büro Fast			
Pondération	LIN			
Début	11:34:46:000 15/04/96			
Fin	11:35:56:000 15/04/96			
Apparition	Durée	Leq	Lmax	SEL
11:34:49:375 15/04/96	0:00:08:250	70.7	77.3	79.9
11:35:05:750 15/04/96	0:00:06:375	72.1	77.5	80.1
11:35:21:000 15/04/96	0:00:06:000	73.7	80.5	81.5
11:35:37:000 15/04/96	0:00:05:875	83.7	88.0	91.4
Total: 4	0:00:26:500	78.1	88.0	92.3

The code 1 (eliminate) may be specified above so that the count of sources events is not affected by possible residual sources.

15.3. Time history of percentiles

It is possible in **dBTRAIT32** to access to the time history of percentiles using the binary cut and paste function of the software.

To do so, follow the procedure shown below.



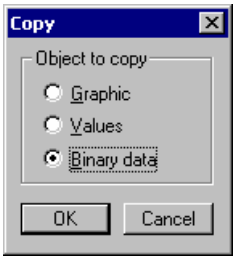
❶ After opening the datafile of interest, use the command **Display / Leq and Ln per period**, as explained in the **paragraph 8.1.2**, and select the statistical indices to calculate.

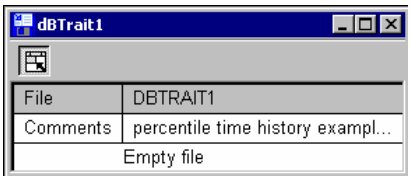
These percentiles will be the ones that will be plotted as a time history later on.

Select the period carefully as well because it will represent the time basis of the plot.

❷ On validation of the previous dialog box, the calculations are made and a table of results is displayed. Then, use the command **Edit / Copy**. The opposite dialog box is displayed.

Select **Binary data** in the field **Object to copy**.





❸ Create a new CMG datafile by the command **File / New** and give a name to this file. An empty datafile is created and its information window is shown on screen.

📖 *It is also possible to paste the binary data in an existing datafile.*

❹ Use the command **Edit / Paste** to copy the binary data relative to percentiles in the empty datafile. All data contained in the previous table of results is then pasted into the empty file.

The information window then looks like this.

dBTrait2

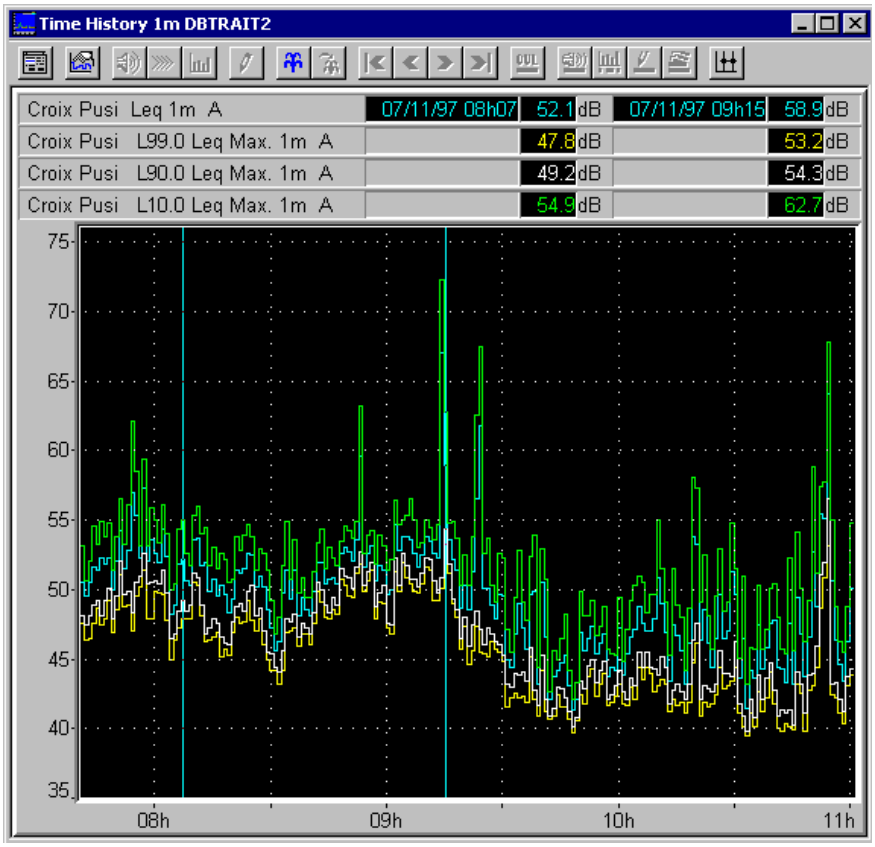
File	DBTRAIT2			
Comments	Ln time history			
Start	07:41:00 vendredi 7 novembre 1997			
End	11:01:00 vendredi 7 novembre 1997			
Time basis	1m			
Total nb of periods	200			
Channel	Type	Wgt	Min.	Max.
Croix Pusi	Leq	A	40	70
Croix Pusi	Leq Min.	A	30	60
Croix Pusi	Leq Max.	A	40	80
Croix Pusi	L99.0 Leq Max.	A	30	60
Croix Pusi	L95.0 Leq Max.	A	30	60
Croix Pusi	L90.0 Leq Max.	A	30	60
Croix Pusi	L50.0 Leq Max.	A	40	70
Croix Pusi	L10.0 Leq Max.	A	40	80
Croix Pusi	L8.0 Leq Max.	A	40	80
Croix Pusi	L5.0 Leq Max.	A	40	80

❻ When the operation is completed, the information of the CMG file features the channels containing the time history of the paste statistical indices.

Save this file by the command **File / Save**.

The user can now display the time history plot of any channels contained in the datafile.

❼ By using the command **Display / Time history**, we obtain a time history plot of percentiles. An example is shown below. See **chapter 4** for more details.



❽ The user can also copy this plot into a word processor or copy the values into a spreadsheet processor or print directly the results as explained in **chapter 12.**

16. TROUBLESHOOTING

When printing graphics, some noise time histories are not shown

The colours that are displayed on screen and on the printer are defined by different commands. If a curve is not displayed correctly, check:

- The background colour of the graph
- The Y axis dynamic range

17. GLOSSARY

17.1. Overall acoustical quantities

17.1.1. Sound pressure level Lp

It is given by the formula: $$L_p = 10\,\mathrm{Log}\left(\frac{P^2(t)}{p_{ref}^2}\right)$$

Where:

P is the root mean square sound pressure level , in Pascal

P_{ref} is the reference sound pressure level (20 µPa)

17.1.2. Equivalent sound pressure level Leq

The LEQ is the equivalent continuous sound pressure level (in decibels) within a time interval. This is the value of the sound pressure level of a continuous, steady sound, that, within a specified time interval t_2-t_1 has the same root mean square value as the sound under consideration whose level varies with time.

The calculation of the Leq from the sound pressure level is given by the formula:

$$L_{EQ} = 10\,\mathrm{Log}\left[\frac{1}{t_1 - t_2}\int_{t_2}^{t_1}\frac{P^2(t)}{P_{ref}^2}dt\right]$$

Where:

$L_{eq,T}$ is the equivalent continuous sound pressure level, in decibels, determined over a reference time interval T starting at t_1 and ending at t_2

P_{ref} is the reference sound pressure level (20 µPa)

P(t) is the instantaneous sound pressure of the sound signal

As a function of the considered time portion, we define a complementary term short LEQ for time intervals that vary from a few milliseconds to a few seconds.

01dB software packages uses the **short Leq** principle. As for the LEQ, the short Leq conserves the energy and a LEQ over a time interval T can be recomposed from short Leqs values, over the considered time portion.

The value of the recomposed Leq for N short Leqs over N elementary periods is given by the formula :

$$L_{eq} = 10\,\mathrm{Log}\left[\frac{1}{N}\sum_{i=1}^{N}10^{(Leq\,i)/10}\right]$$

Where:

N is the number of elemental periods

Leq,T is the short Leq corresponding to the ith sample, expressed in dB.

Each short Leq sample can be associated with a noise source (using the coding technique). Therefore, each time portion of a measurement can be assigned to a specific noise event, allowing us to calculate specific indicators related to noise events.

The value of the recomposed Leq for N short Leqs (for a specific noise event) over N elementary periods is given by the same formula.

17.1.3. Peak level

The Peak level is the maximum absolute value of instantaneous sound pressure within a time interval. It is expressed in dB (ref 2e-5 Pa).

17.1.4. Percentiles (Statistical indices)

The percentile Ln is the sound pressure level that is exceeded N % of the time interval considered.

Symbols

- LN,T for example, $L_{95,1H}$ is the level exceeded for 95% of 1h
- L100 (value exceeded during 100% of the time interval) value is also called LMIN
- L0 (value exceeded during 0% of the time interval) value is called LMAX

17.1.5. LMIN

It is the minimum short term LEQ value for the considered time period. For a defined time interval, a certain number of short term LEQ are to be considered. The LMIN value is the lowest value for each time interval (Period). It is equivalent to the L100 value.

17.1.6. LMAX

It is the maximum short term LEQ value for the considered time period. For a defined time interval, a certain number of short term LEQ are to be considered. The LMAX value is the highest value for each time interval (Period). It is equivalent to the L0 value.

17.2. Acoustical quantities relative to noise sources

A **noise source** is a specific type of noise, which appeared during the measurement. A noise source is usually composed of several noise events (appearances). Each source is defined by its name and a **unique** code number.

Noise source identification is one of the most important elements of short Leq technique. A special information (source code) may be assigned to each elemental time period. Coding noise data is described in **chapter 6.**

Once noise events have been coded, the following indicators may be calculated.

17.2.1. Particular Leq

Equivalent sound pressure level, in decibels, corresponding to a specific source and related to its duration of action. The formula is given below:

$$L_{eqparticular} = \frac{1}{\sum \Delta t} \int_{\Sigma \Delta t} \frac{P^2(t)}{P_0^2} dt$$

Where:

Delta T sum is the cumulated duration of action of the considered noise source

P_0 is the reference sound pressure level (20 µPa)

P(t) is the instantaneous sound pressure of the sound signal

📖 *It is also possible to relate the energy of the source to the complete time period by calculating the partial LEQ.*

17.2.2. Partial Leq

The equivalent sound pressure level, in decibels, corresponding to a specific source and related to the whole considered time interval. It is given by the formula:

$$L_{eqpartial} = \frac{1}{T} \int_{\Sigma \Delta t} \frac{P^2(t)}{p_0^2} dt$$

Where:

Delta T sum is the cumulated duration of action of the considered noise source

P_0 is the reference sound pressure level (20 µPa)

P(t) is the instantaneous sound pressure of the sound signal

📖 *It is also possible to relate the energy of the source to its own duration of action by calculating the particular LEQ.*

17.2.3. Sound Exposure Level

Averaged energy of a discrete noise event of a source over the selected time period related to a 1 second time interval. It is usually called : SEL. It is given by the formula:

$$SEL = 10 \log \frac{1}{t_0} \int_{t_1}^{t_2} \frac{p^2(t)}{p_{ref}^2} dt$$

Where:

P(t) is the instantaneous sound pressure

$t_2 - t_1$ is a stated time interval long enough to encompass all significant sound of a stated event

P_0 is the reference sound pressure level (20 µPa)

t_0 is the reference duration 1 s

17.2.4. Standard Deviation

The standard deviation is given by the formula :

$$\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(e_i-\bar{e})^2}$$

Where:

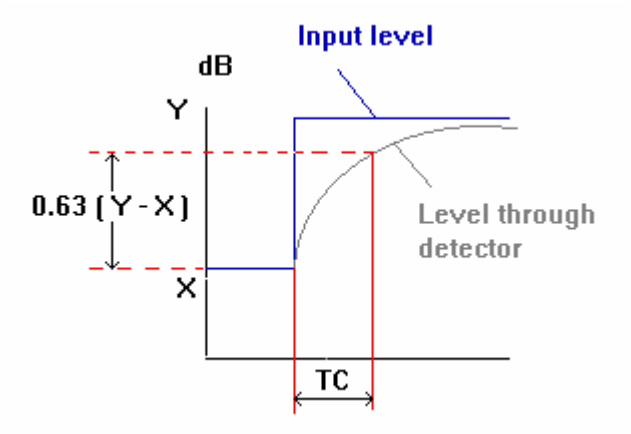
n = number of samples considered

e_i = *i* th sample

ë = mean value.

17.3. Time weightings

This is the result of an RC type integration with a specific time constant. As the input level varies from X to Y and remains at Y, the time constant is the time requested by the detector to reach 63 % of the distance between X and Y



17.3.1. SLOW time weighting

This is the result of an RC type integration with 1-second time constant. As the input level varies from X to Y and remains at Y, the time constant is the time requested by the detector to reach 63 % of the distance between X and Y.

For the Slow time weighting : TC = 1000 milliseconds..

17.3.2. FAST time weighting

This is the result of an RC type integration with 125 milliseconds time constant. As the input level varies from X to Y and remains at Y, the time constant is the time requested by the detector to reach 63 % of the distance between X and Y.

For the Fast time weighting : TC = 125 milliseconds.

17.3.3. IMPULSE time weighting

This weighting is a combined result of an RC type integration with 35 milliseconds time constant for increasing slope followed by an RC type integration with 35 milliseconds time constant for decreasing slope.

For the Impulse time weighting : TC = 35 milliseconds (increasing level) and TC = 3000 milliseconds (decreasing level).

17.3.4. User defined time weighting RC

This is the result of an RC type integration with A milliseconds time constant. As the input level varies from X to Y and remains at Y, the time constant is the time requested by the detector to reach 63 % of the distance between X and Y.

For the user-defined time weighting : TC = A milliseconds (A defined by the user).

17.4. Frequency weighting networks

The weighting networks used in acoustics have been defined from the basic research of Fletcher and Munson in 1933. The goal of the study was to determine the influence of the human ear as a function of frequency and level. From these studies, the Equal Loudness contours have been defined. They were the basis of the weighting networks definition. The aim of the weighting networks is to provide a level as close as possible to subjective perception (as they integrate the human ear attenuation and hence describe the subjective impression of a noise).

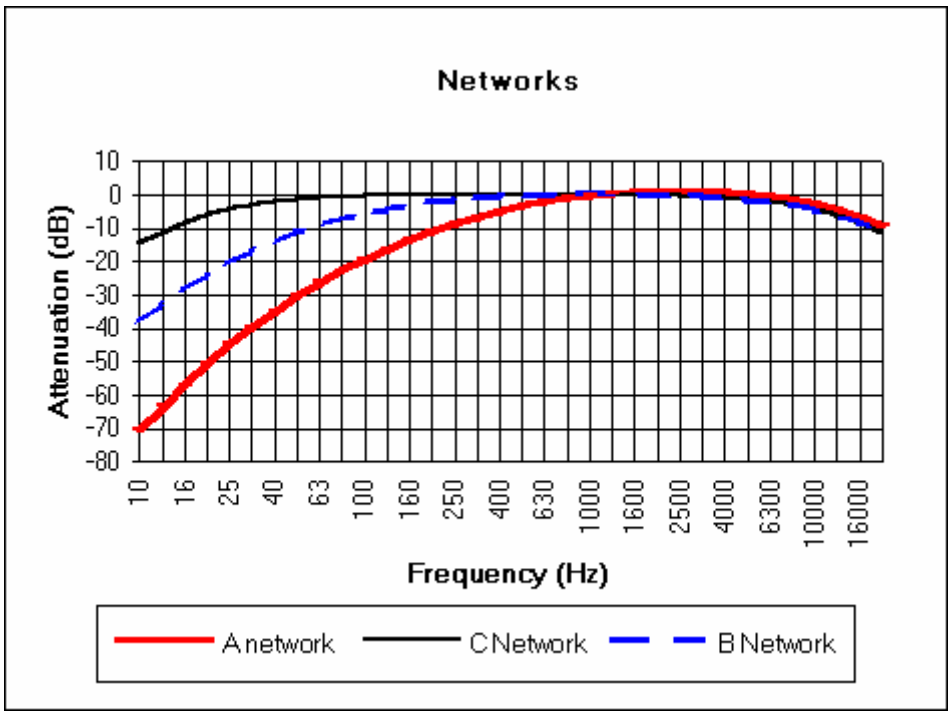
The A network corresponds to the sensitivity of the human ear at low levels, the B network to medium levels and the C network to high levels. In the field of environmental noise, for instance, most measurements are performed using the A network.

The A weighting is the network which correlates the best with the human ear. It attenuates both low and high frequencies and magnifies the frequencies around 2 kHz (the frequency range where the human ear is the most sensitive).

The C weighting looks much like the A weighting at high frequencies and is flat in frequencies below 1kHz.

The table and curves below describe the various networks.

17.4.1. Comparative curves of the usual Weighting Networks



17.4.2. Correction table of the Weighting Networks versus frequency

Nominal frequency (Hz)	Exact frequency (Hz)	A	B	C	Nominal frequency (Hz)	Exact frequency (Hz)	A	B	C
10	10	-70.4	-38.2	-14.3	500	501.2	-3.2	-0.3	-0.0
12.5	12.59	-63.4	-33.2	-11.2	630	631.0	-1.9	-0.1	-0.0
16	15.85	-56.7	-28.5	-8.5	800	794.3	-0.8	-0.0	-0.0
20	19.95	-50.5	-24.2	-6.2	1000	1000	0	0	0
25	25.12	-44.7	-20.4	-4.4	1250	1259	+0.6	-0.0	-0.0
31.5	31.62	-39.4	-17.1	-3.0	1600	1585	+1.0	-0.0	-0.1
40	39.81	-34.6	-14.2	-2.0	2000	1995	+1.2	-0.1	-0.2
50	50.12	-30.2	-11.6	-1.3	2500	2512	+1.3	-0.2	-0.3
63	63.10	-26.2	-9.3	-0.8	3150	3162	+1.2	-0.4	-0.5
80	79.43	-22.5	-7.4	-0.5	4000	3981	+1.0	-0.7	-0.8
100	100.0	-19.1	-5.6	-0.3	5000	5012	+0.5	-1.2	-1.3
125	125.9	-16.1	-4.2	-0.2	6300	6310	-0.1	-1.9	-2.0
160	158.5	-13.4	-3.0	-0.1	8000	7943	-1.1	-2.9	-3.0
200	199.5	-10.9	-2.0	-0.0	10000	10000	-2.5	-4.3	-4.4
250	251.2	-8.6	-1.3	-0.0	12500	12590	-4.3	-6.1	-6.2
315	316.2	-6.6	-0.8	-0.0	16000	15850	-6.6	-8.4	-8.5
400	398.1	-4.8	-0.5	-0.0	20000	19950	-9.3	-11.1	-11.2

17.4.3. Transfer function of the corresponding filters

- A weighting network:

$$H(p) = \frac{4\pi^2.12200^2.P^4}{(P+2\pi.20.6)^2(P+2\pi.12200)^2(P+2\pi.107.7)(P+2\pi.737.9)}$$

- B weighting network

$$H(p) = \frac{4\pi^2.12200^2.P^3}{(P+2\pi.20.6)^2(P+2\pi.12200)^2(P+2\pi.158.5)}$$

- C weighting network

$$H(p) = \frac{4\pi^2.12200^2.P^2}{(P+2\pi.20.6)^2(P+2\pi.12200)^2}$$

17.5. Spectra

It is a representation of the frequency components of a signal. A spectrum of a signal is obtained via frequency analysis. It is usually displayed in one of the following forms: narrow bands, octave bands, third octave bands.

17.5.1. Octave and third octave bands

An **octave band** is a frequency band whose pass-band limit follows a ration of 2 (between a given frequency and the double of it). An octave is determined by its central frequency. A third octave band is frequency band whose pass-band limits follows a ration of $2^{1/3}$.
The usual octave and third octaves bands are centred on preferred frequencies as describes in IEC 1260.

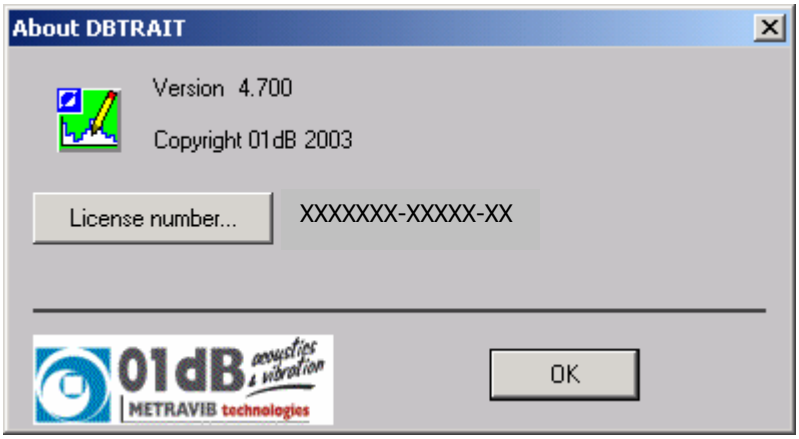
17.5.2. Octave and third octave: standardised bandwidth and centre frequencies

N°	Designation	Third octave pass band	Width	Octave Passband	Width
43	20 kHz	17.8-22.4 kHz	4600 Hz	11.2-22.4 kHz	11200 Hz
42	16 kHz	14.1-17.8 kHz	3700 Hz		
41	12.5 kHz	11.2-14.1 kHz	2900 Hz		
40	10 kHz	8910-11200 Hz	2290 Hz	5620-11200 Hz	5600 Hz
39	8 000hz	7080-8910 Hz	1830 Hz		
38	6 300 Hz	5620-7080 Hz	1460 Hz		
37	5 000 Hz	4470-5620 Hz	1150 Hz	2820-5620 Hz	2820 Hz
36	4 000 Hz	3550-4470 Hz	920 Hz		
35	3 150 Hz	2820-3550 Hz	730 Hz		
34	2 500 Hz	2240-2820 Hz	580 Hz	1410-2820 Hz	1410 Hz
33	2 000 Hz	1780-2240 Hz	460 Hz		
32	1 600 Hz	1410-1780 Hz	370 Hz		
31	1 250 Hz	1120-1410 Hz	290 Hz	708-1410 Hz	708 Hz
30	1 000 Hz	891-1120 Hz	229 Hz		
29	800 Hz	708-891 Hz	183 Hz		
28	630 Hz	562-708 Hz	146 Hz	355-708 Hz	355 Hz
27	500 Hz	447-562 Hz	115 Hz		
26	400 Hz	355-447 Hz	92 Hz		
25	315 Hz	282-355 Hz	73 Hz	178-355 Hz	178 Hz
24	250 Hz	224-282 Hz	58 Hz		
23	200 Hz	178-224 Hz	46 Hz		
22	160 Hz	141-178 Hz	37 Hz	89.1-178 Hz	89.1 Hz
21	125 Hz	112-141 Hz	29 Hz		
20	100 Hz	89.1-112 Hz	22.9 Hz		
19	80 Hz	70.8-89.1 Hz	18.3 Hz	44.7-89.1 Hz	44.7 Hz
18	63 Hz	56.2-70.8 Hz	14.6 Hz		
17	50 Hz	44.7-56.2 Hz	11.5 Hz		
16	40 Hz	35.5-44.7 Hz	9.2 Hz	22.4-44.7 Hz	22.4 Hz
15	31.5 Hz	28.2-35.5 Hz	7.3 Hz		
14	25 Hz	22.4-28.2 Hz	5.8 Hz		
13	20 Hz	17.8-22.4 Hz	4.6 Hz	11.2-22.4 Hz	11.2 Hz
12	16 Hz	14.1-17.8 Hz	3.7 Hz		
11	12.5 Hz	11.2-14.1 Hz	2.9 Hz		
10	10 Hz	8.91-11.2 Hz	2.29 Hz	5.62-11.2 Hz	5.62 Hz
9	8 Hz	7.08-8.91 Hz	1.83 Hz		
8	6.3 Hz	5.62-7.08 Hz	1.46 Hz		
7	5 Hz	4.47-5.62 Hz	1.15 Hz	2.82-5.62 Hz	2.82 Hz
6	4 Hz	3.55-4.47 Hz	0.92 Hz		
5	3.15 Hz	2.82-3.55 Hz	0.73 Hz		
4	2.5 Hz	2.24-2.82 Hz	0.58 Hz	1.41-2.82 Hz	1.41 Hz
3	2 Hz H	1.78-2.24 Hz	0.46 Hz		
2	1.6 Hz	1.41-1.78 Hz	0.37 Hz		
1	1.25 Hz	1.12-1.41 Hz	0.29 Hz	0.708-1.41 Hz	0.708 Hz
	1 Hz	0.891-1.12 Hz	0.229 Hz		
	0.8 Hz	0.705-0.891 Hz	0.183 Hz		

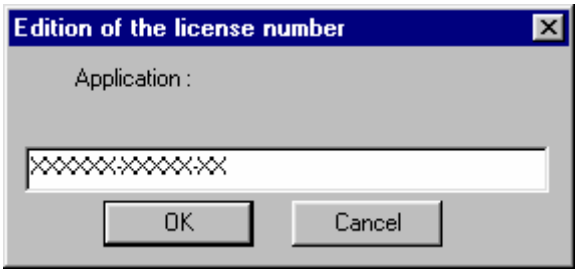
18. APPENDIX

18.1. Editing the software licence number

Use this command (menu **? / About dBTRAIT**) to obtain general information on the software version, copyright and licence number.



If the licence number of the software module has to be modified, click on the key **Licence number**. The following dialog box appears on screen:



Enter the new licence number, provided by 01dB technical support.

Start again the application software in order to account for this modification.